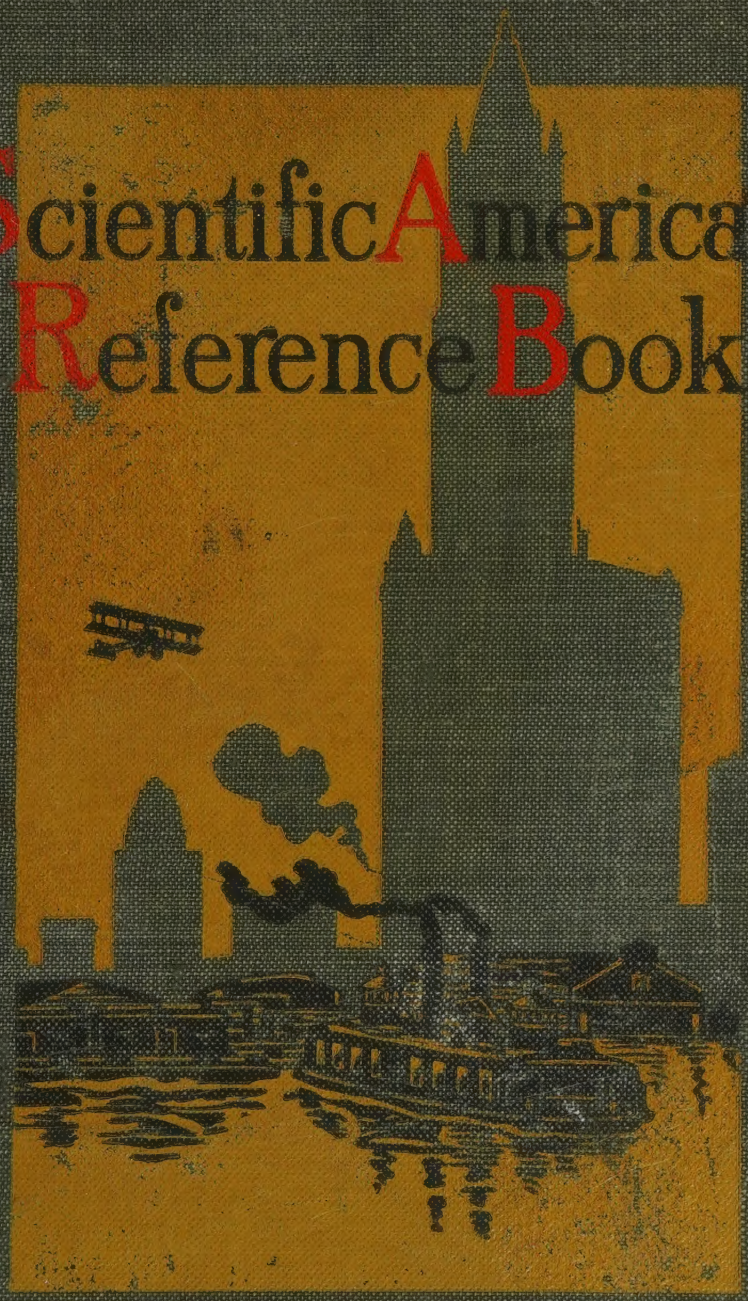
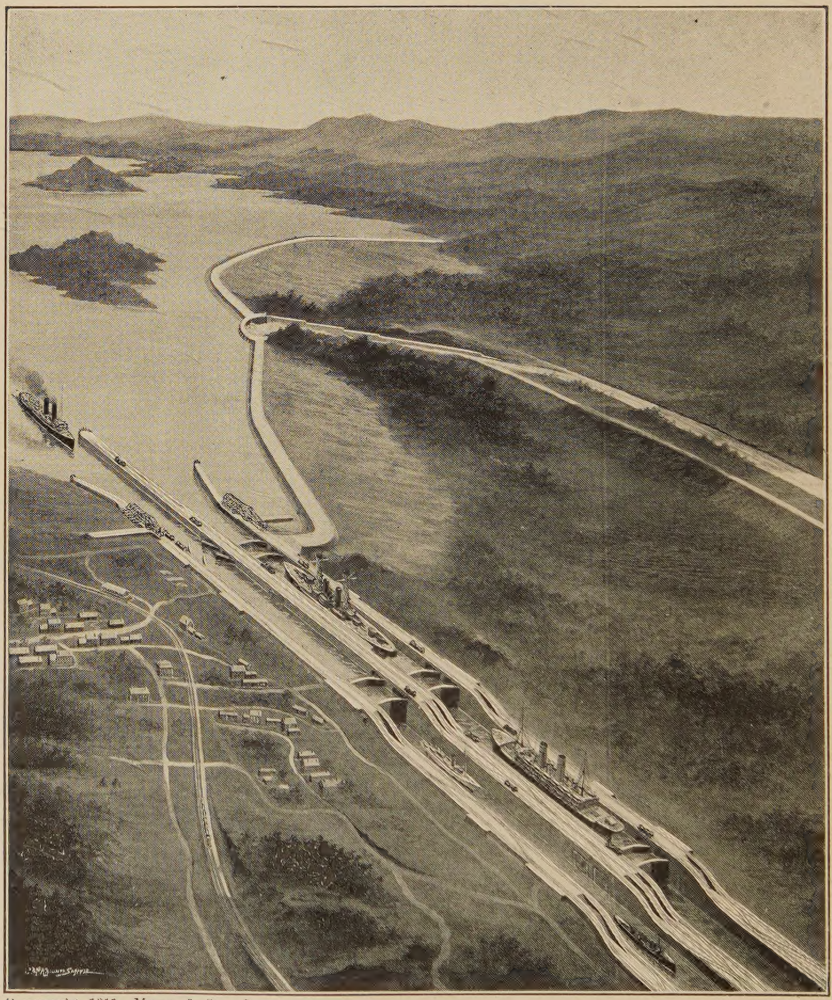
Scientific American Reference Book



To Jack

From

Sol.



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BIRD'S-EYE VIEW OF THE DOUBLE LOCKS AT GATUN. TOTAL RISE FROM SEA LEVEL TO LAKE LEVEL, 85 FEET.

Scientific American Reference Book

Edition *of* 1913

Compiled and Edited

by

ALBERT A. HOPKINS

For Part I. Statistical Information

Editor of Scientific American Cyclopedia of Formulas
Scientific American Handbook of Travel, Etc.
Member of the American Statistical Association

and

A. RUSSELL BOND

For Part II. Scientific Information

Editor of Handyman's
Workshop and Laboratory

With 1000 Illustrations

MUNN & CO., Inc.

NEW YORK, 1913

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PREFACE.

The Editorial staff of the "Scientific American" receives annually about 15,000 inquiries covering a wide range of topics—no field of human achievement or of natural phenomena is neglected. The information sought for, in many cases, cannot be readily found in text-books or works of reference. The need of a compendium of useful information presented itself some twenty years ago, and a part of the field was covered by the publication in 1901 of the "Scientific American Cyclopedia of Receipts, Notes, and Queries," of which over 25,000 copies were sold. This book becoming obsolete in time was supplanted by its successor, the "Scientific American Cyclopedia of Formulas," issued in 1911. There was, however, another field which was not covered: the public, or at least the public of the "Scientific American," demanded something which did not exist—they wanted a book which should deal with a vast range of topics other than formulæ. They wanted information about the Antarctic region, the Panama route, shipping, navies, armies, railroads, population, education, patents, submarine cables, wireless telegraphy, manufactures, agriculture, mining, mechanical movements, astronomy and the weather. The Editors of the present volume felt constrained to compile such a book, which was issued in 1904, under the same title as this book. Its success was immediate, and an edition of 10,000 copies was inadequate to supply the demand. In 1905 a second large edition was issued, and was eagerly bought up by those who wished this useful companion for the desk or library. As the

figures became obsolete, it was allowed to become "out of print," and now in response to a considerable number of requests a new book is presented, following to some extent the old lines, but entirely recompiled and rewritten.

Immense masses of Government material have been digested with painstaking care by competent statisticians, and the result will, in the judgment of the Editors, fully warrant the expenditure of considerable effort and results in the production of a unique book.

It is perhaps necessary to call attention to the fact that there are certain inconsistencies in the tables. In procuring the figures, for example, from different bureaus and departments of the Government, with reference to any subject, it is found that statistics vary in certain particulars. These differences are due to the different methods of tabulation or to different points of view. In many cases these discrepancies are noted in this book, to prevent the reader from forming erroneous conclusions. These cases must not be regarded as errors, and an attempt has been made to give, wherever possible, the date of the figures and the authority. Every available space has been taken up with useful information, whether germane to the chapter or not.

The debt for advice and help is a heavy one. The compilation of this or any similar one would be impossible without the co-operation of many Government officials. Our thanks are especially due to Dr. Falkner, late Assistant Director of the Census, and to the Hon. E. Dana Durand, Director of the Census; the Hon. O. P. Austin, late Chief of the Bureau of Statistics and now Assistant-Chief of the new Bureau of Domestic and Foreign Commerce, and to Mr. N. Eckhardt, Jr., of his office; to the Hon. Eugene Tyler Chamberlain, Commissioner of Navigation; to Captain T. M. Potts, of the United States

Navy; to Major J. D. Leitch, U. S. A., Secretary of the War College Division; to Mr. C. F. Talman, of the Weather Bureau, for his condensed chapter on the weather; to Senator Wm. Alden Smith; to Mr. Slason Thompson, of the Bureau of Railway News and Statistics; to the Hon. S. B. Donnelly, Public Printer; to Dr. J. A. Holmes, Chief of the Bureau of Mines; to the Hon. Frank H. Hitchcock, Postmaster-General; to Dr. A. F. Zahm; to Dr. W. W. Share; to Dr. Geo. F. Kunz; to Mr. Perry B. Turpin; to Dr. F. L. Hoffman, Statistician of the Prudential Life Insurance Co.; to Captain J. L. Jayne, U. S. N., Superintendent of the U. S. Naval Observatory; to Captain A. W. Lewis, of the Associated Press; to Mr. E. Justice, of the North German Lloyd Steamship Co.; to the painstaking assistants, Miss Henrietta von Tobel and Mr. Albert S. Regula; and to a host of other friends whose help was invaluable. A number of interesting comparisons in line are from Prof. A. L. Hickmann's Geographical-Statistical Universal Atlas and Philips' Chamber of Commerce Atlas. Acknowledgment is made for matter from The American Almanac and Year Book, The World Almanac and the Chicago Daily News Almanac and Year Book, The Statistical Abstract of the United States, and the publications of the Census. Many items are credited where used.

New York,
October 15, 1912.

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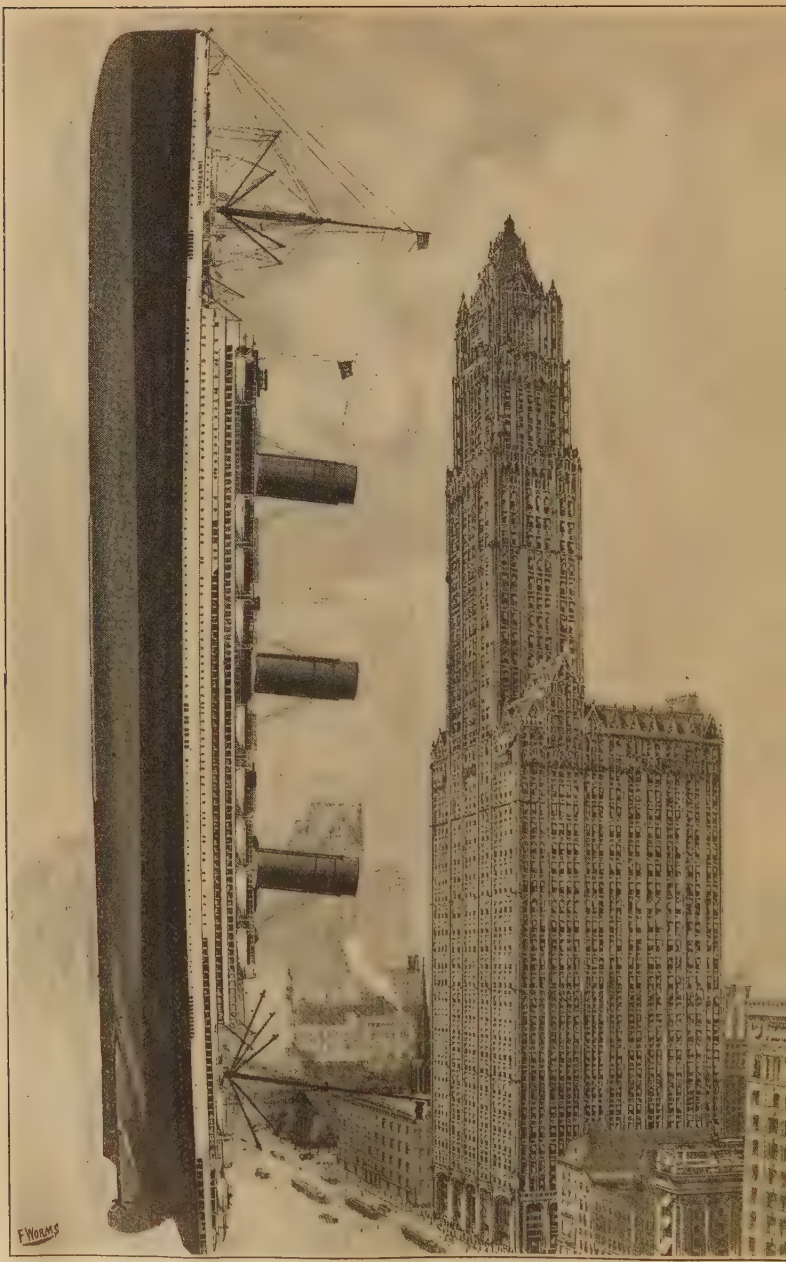
NOTE.—A complete Table of Contents is of little value where a complete Index is provided. Those interested in a subject will find little hardship in perusing the whole chapter devoted to it.



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THE LONGEST SHIP AND THE TALLEST BUILDING.

The "Imperator," 900 feet; Woolworth Building, 750 feet.

PART I.

STATISTICAL INFORMATION.

CHAPTER I.

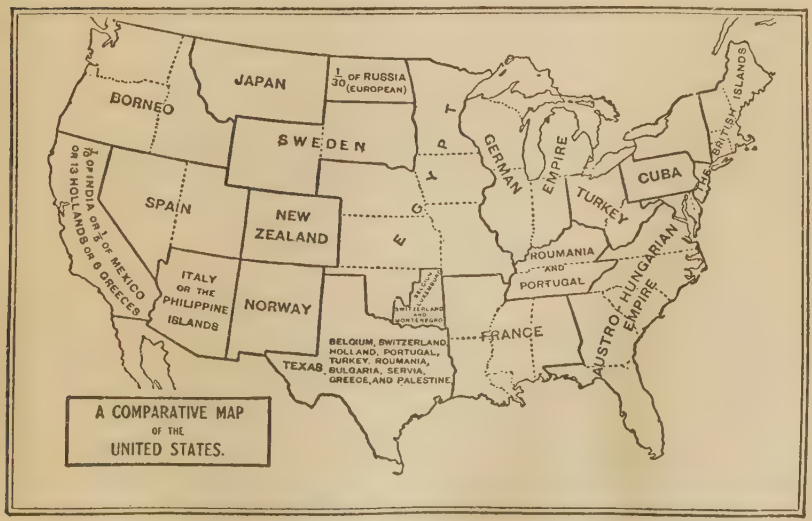
POPULATION AND SOCIAL STATISTICS.

POPULATION OF THE UNITED STATES.

AREA.	1910	1900
The United States (total area of enumeration)	**93,402,151**	[1] **77,256,630**
Continental United States	91,972,266	75,994,575
Noncontiguous territory	1,429,885	1,262,055
Alaska	64,356	63,592
Hawaii	191,909	154,001
Porto Rico	1,118,012	[2] 953,243
Persons in military and naval service stationed abroad	55,608	91,219

[1] Includes 953,243 persons enumerated in Porto Rico in 1899.
[2] According to the census of Porto Rico taken in 1899 under the direction of the War Department.

COMPARATIVE AREA OF THE UNITED STATES AND FOREIGN COUNTRIES.



Items.	1790.	1850.	1870.	1900.	1911.
Area[1] ..... sq. miles	867,980	2,997,119	3,026,789	3,026,789	3,026,789
Population[2]	3,929,214	23,191,876	38,558,371	75,994,575	93,792,509
Population[2] ..... per sq. mile	4.79	7.88	12.96	25.55	31.54
Wealth[3,4] ..... dollars	.....	7,135,780,000	30,068,518,000	88,517,306,775	.....
Wealth per capita[3,4] ..... dollars	.....	307.69	779.83	1,164.79	.....
Debt, less cash in Treasury[5] ..... dollars	[6]75,463,477	63,452,774	2,331,169,956	1,107,711,258	1,015,784,338
Debt, per capita ..... dollars	[6]18.86	2.74	60.46	14.58	10.83
Interest-bearing debt[7] ..... dollars	[6]75,463,477	63,452,774	2,046,455,722	1,023,478,860	915,353,190
Annual interest charge ..... dollars	[8]1,177,863	3,782,393	118,784,960	33,545,130	21,336,673
Interest per capita ..... dollars	[8]0.29	0.16	3.08	0.44	0.23
Gold coined ..... dollars	[9]71,485	31,981,739	23,198,788	99,272,943	56,176,823
Silver coined ..... dollars	[9]370,684	1,866,100	1,378,256	36,345,321	6,457,302
Gold in circulation[10] ..... dollars	}	147,395,456	25,000,000	} 610,806,472	[11]589,295,538
Silver in circulation[10] ..... dollars	}	.....	.....	} 142,050,334	[12]210,867,772
Gold certificates in circulation ..... dollars	.....	.....	.....	200,733,019	930,367,929
Silver certificates in circulation ..... dollars	.....	.....	.....	408,465,574	453,543,696
U. S. notes in circulation ..... dollars	.....	.....	324,962,638	313,971,545	338,989,122
National bank notes in circulation ..... dollars	.....	.....	288,648,081	300,115,112	687,701,283
Miscellaneous currency[12] ..... dollars	.....	131,366,526	36,602,075	79,008,942	3,237,256
Circulation of money ..... dollars	.....	278,761,982	675,212,794	2,055,150,998	[11] 3,214,002,596
Per capita ..... dollars	.....	12.02	17.50	26.93	[11]34.20
National banks ..... number	.....	.....	1,612	3,732	7,277
Capital ..... dollars	.....	.....	427,235,701	621,536,461	1,019,633,152
Bank clearings, New York ..... dollars	.....	.....	27,804,539,406	51,964,588,564	92,420,120,000
Total, United States ..... dollars	.....	.....	.....	84,582,450,081	159,373,450,000
Individual deposits, national banks ..... dollars	.....	.....	542,261,563	2,458,092,758	5,477,991,156
Deposits in savings banks ..... dollars	.....	43,431,130	549,874,358	2,389,719,954	4,212,583,599
Depositors, savings banks ..... number	.....	251,354	1,630,846	6,107,083	9,794,647
Farms and farm property[3] ..... dollars	.....	3,967,343,580	[13]8,944,857,749	[14]20,439,901,164	[15]40,991,449,090
Farm products, value[3] ..... dollars	.....	.....	[13]1,958,030,927	4,417,069,973	[16]8,417,000,000
Manufacturing establishments[3] ..... number	.....	123,025	252,148	512,254	[17]268,461
Value of products[3] ..... dollars	.....	1,019,106,616	4,232,325,442	13,004,400,143	[17]20,672,051,870
Receipts—ordinary[18] ..... dollars	[8]4,409,951	43,592,889	395,959,834	567,240,852	701,372,375
Customs ..... dollars	[8]4,399,473	39,668,686	194,538,374	233,164,871	314,497,071
Internal revenue ..... dollars	[19]208,943	.....	184,899,756	295,327,927	[20]322,529,201
Disbursements—ordinary[21] ..... dollars	[8]3,097,453	40,948,383	293,657,005	487,713,792	654,137,998
War ..... dollars	[8]632,804	9,687,025	57,655,675	134,774,768	160,135,976
Navy ..... dollars	[22]61,409	7,904,725	21,780,230	55,953,078	119,937,644
Pensions ..... dollars	[8]175,814	1,866,886	28,340,202	140,877,316	157,980,575
Interest on public debt ..... dollars	[8]1,177,863	3,782,393	129,235,498	40,160,333	21,311,334
Imports of merchandise ..... dollars	23,000,000	173,509,526	435,958,408	849,941,184	1,527,226,105
Per capita ..... dollars	5.85	7.48	[23]11.06	10.93	16.05
Exports of merchandise ..... dollars	20,205,156	144,375,726	392,771,768	1,394,483,082	2,049,320,199
Per capita ..... dollars	5.14	6.23	[24]9.77	17.76	21.15

Items.		1790.	1850.	1870.	1900.	1911.
Imports—Silk, raw	pounds					
Rubber, crude	pounds			583,589	11,259,310	22,379,998
Tin plates	pounds			9,624,098	49,377,138	72,046,260
Iron, steel, manufactures of	dollars	115,980	20,145,067	150,932,768	147,963,804	95,319,730
Domestic exports:				40,273,682	20,478,728	35,984,303
All manufactures	dollars		23,223,106	70,040,845	484,846,235	907,519,841
Iron and steel manufactures	dollars		1,953,702	13,483,163	121,913,548	230,725,352
Farm animals—Value	dollars		544,180,516	1,524,960,149	2,228,123,134	[25]5,276,438,000
Cattle	number		17,778,907	25,484,100	43,902,414	[26]60,502,000
Horses	number		4,336,719	8,248,800	13,537,524	[25]20,277,000
Sheep	number		21,773,220	40,853,000	41,883,065	[25]53,633,000
Mules	number		559,331	1,179,500	2,086,027	[25]4,323,000
Swine	number		30,354,213	26,751,400	37,079,356	[25]65,620,000
Production of gold	dollars		50,000,000	50,000,000	79,171,000	96,233,528
Silver, commercial value	dollars		50,900	16,434,000	35,741,100	31,787,866
Coal	tons		6,266,233	29,496,154	240,789,319	[26]443,025,275
Petroleum	gallons			220,951,290	2,672,062,218	[26]9,258,874,422
Pig iron	tons		563,755	1,665,179	13,789,242	23,649,547
Steel	tons			68,750	10,188,329	23,676,106
Tin plates	pounds				849,004,022	[27]1,619,005,000
Copper	tons		650	12,600	270,588	489,836
Wool	pounds		52,516,959	162,000,000	288,636,621	318,547,900
Wheat	bushels		100,485,944	235,884,700	522,229,505	621,338,000
Corn	bushels		592,071,104	1,094,255,000	2,105,102,516	2,531,488,000
Cotton	running bales	6,667	2,454,442	4,352,317	10,245,602	16,109,349
Cane sugar	pounds		247,577,000	87,043,000	322,549,011	696,640,000
Sugar consumed	pounds			1,261,941,665	4,477,175,236	7,222,532,746
Cotton consumed	500-pound bales	11,000	422,626	1,026,583	3,603,516	[27]4,516,779
Domestic cotton exported	pounds	[28]2,027	638,381,604	958,558,523	3,100,583,188	4,033,940,915
Railways in operation	miles		9.021	52,922	198,964	[26]246,124
Passengers carried	number				576,831,251	[26]997,409 882
Freight carried 1 mile	tons				141,596,551,161	[26]253,783,701,839
Revenue, ton per mile	cents				.729	[26].757
Passenger cars	number				34,713	[26]49,818
Other cars	number				1,416,125	[28]2,309,517
American vessels—Built[29]	tons	[30]56,679	279,255	276,953	393,790	291,162
Trading, domestic, etc	tons	132,123	1,949,743	2,729,707	4,338,145	6,766,119
Trading, foreign, etc	tons	346,254	1,585,711	1,516,800	826,694	872,671
On Great Lakes	tons		198,266	684,704	1,565,587	2,943,523
Vessels through "Soo" Canal	tons			690,826	22,315,834	41,653,488
Commercial failures	number			3,540	10,774	13,441
Amount of liabilities	dollars			88,242,009	138,495,673	191,061,665
Post offices	number	75	18,417	28,492	76,688	59,237

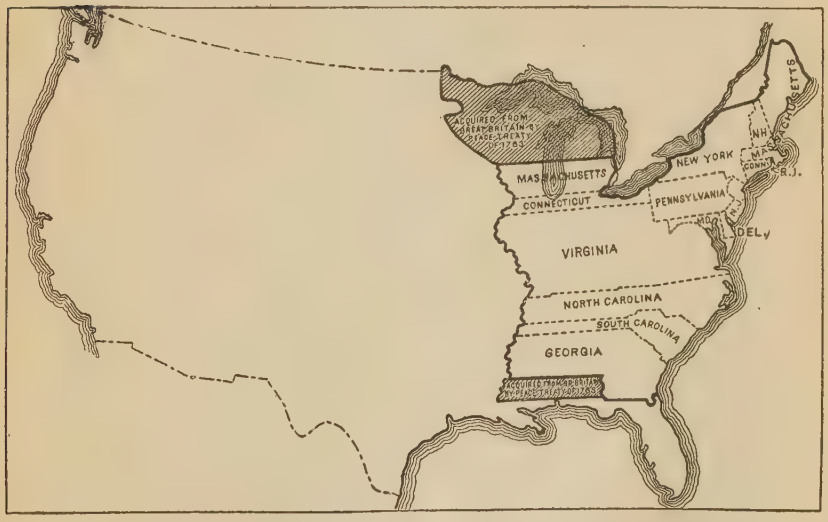
Items.	1790.	1850.	1870.	1900.	1911.
Receipts P. O. Dept.....dollars.....	71,296	5,499,984	19,772,221	102,354,579	237,879,824
Telegrams sent[31].....number.....	.....	.....	9,157,646	79,696,227	[32]77,780,732
Newspapers, etc.[33].....number.....	.....	2,526	5,871	20,806	22,806
Public schools, salaries.....dollars.....	.....	.....	37,832,566	137,687,746	[27, 34]253,915,170
Patents issued .....number.....	.....	993	13,333	26,499	34,084
Immigrants arrived[35].....number.....	.....	369,980	387,203	448,572	878,587

[1]Exclusive of Alaska and islands belonging to the United States.
[2]Census figures, relating to Continental United States; the figures for 1911 represent an estimate. [3]Census figures.
[4]True valuation of real and personal property. [5]1791 to 1850, outstanding principal of the public debt. January 1. [6]1791.
[7]Figures for the years 1791 to 1850 include the total public debt. [8]1791 (34 months). [9]1793-1795.
[10]Gold and silver can not be stated separately prior to 1876. From 1862 to 1875, inclusive, gold and silver were not in circulation except on the Pacific coast, where it is estimated that the average specie circulation was about $25,000,000, and this estimate is continued for the three following years under the head of gold. After that period gold was available for circulation.
[11]As the result of special investigation by the Director of the Mint a reduction of $135,000,000 was made in the estimate of gold coin in circulation on July 1, 1907, as compared with the basis of previous years, and on September 1, 1910, a reduction of $9,700,000 was made in the estimate of silver coin
[12]Includes notes of Bank of United States; State-bank notes; demand notes of 1862 and 1863; fractional currency, 1863 to 1878; Treasury notes of 1890, 1891 to date; and currency certificates, act of June 8, 1872, 1892 to 1900
[13]Gold values, being 80 per cent of currency values reported. Figures of products include betterments and additions to live stock.
[14]Includes value of buildings, $3,556,639,496. The Twelfth Census was the first to collect statistics of buildings on farms.
[15]Figures relate to 1910 and include value of buildings, $6,325,451,528.
[16]Data of the Department of Agriculture representing wealth production on farms.
[17]Figures relate to the census of 1910, cover the calendar year 1909, and are exclusive of neighborhood industries and hand trades, included in previous years.
[18]"Ordinary receipts" include receipts from customs, internal revenue, direct tax, public lands, and "miscellaneous," but do not include receipts from loans, premiums, Treasury notes, or revenues of Post Office Department.
[19]1792. [20]Includes corporation tax, $33,516,977.
[21]"Ordinary disbursements" include disbursements for War, Navy, Indians, pensions, payments for interest, and "miscellaneous," but do not include payments for premiums, principal of public debt, or disbursements for postal service paid from revenues thereof.
[22]1794. [23]Imports for consumption after 1850.
[24]Domestic exports only after 1850.
[25]January 1, 1911.
[26]Preliminary figures.
[27]1910.
[28]Equivalent 500-pound bales.
[29]Includes canal boats and barges prior to 1870.
[30]1797.
[31]Western Union to 1870; includes Postal Telegraph after 1870, except that in 1911 the figures relate to the Western Union only.
[32]Not including messages sent by Western Union over leased wires or under railroad contracts.
[33]1850, from census of 1880; 1870 to 1906, from Rowell's Newspaper Directory; after 1900, from Ayer's American Newspaper Annual. Figures for 1911 include outlying possessions.
[34]Includes salaries of teachers only.
[35]1850, total alien passengers arrived; 1850, 15 months ending December 31; after 1850, fiscal years ending June 30.

AREA OF THE UNITED STATES.

ACCESSION.	Gross area in square miles.	ACCESSION.	Gross area in square miles.
Continental U. S.	**3,026,789**	**Outlying possessions**	**716,517**
Area of U. S. in 1790[1]	892,135	Alaska, 1867	590,884
Louisiana Purchase, 1803	827,987	Hawaii, 1898	6,449
Florida, 1819	58,666	Philippine Islands, 1899	115,026
Territory gained through Treaty with Spain, 1819	13,435	Porto Rico, 1899	3,435
Texas, 1845	389,166	Guam, 1899	210
Oregon, 1846	286,541	Samoa, 1900	77
Mexican Cession, 1848	529,189	Panama Canal Zone, 1904	436
Gadsden Purchase, 1853	29,670		

[1] Includes the drainage basin of the Red River of the North, not a part of any acquisition, but previously considered a part of the Louisiana Purchase.



THE THIRTEEN ORIGINAL STATES, WITH THE ACCESSIONS OF TERRITORY GRANTED BY THE TREATY OF 1783 WITH GREAT BRITAIN

GREATEST EARTHQUAKES OF MODERN TIMES.

The greatest earthquake of modern times was that of Sicily and Calabria, December 28, 1908. The shock lasted but 35 seconds and resulted in the death of 76,483 persons, and injuries to 95,470; it is estimated that 1,100,000 persons were made homeless; no estimate of the property loss was attempted. In Sicily the chief cities and towns destroyed or damaged were Messina, Faro, Santa Teresa and Scalleta. In Calabria: Reggio, Gallico, San Giovanni, San Eufemia, Pellaro, Palmi and Cannitello. The San Francisco earthquake of April 18, 1906 resulted in the death of 452 persons, and injuries to 1,500; an estimate of the persons made homeless was given as 265,000. 60,000 buildings were destroyed, resulting in a property loss of $350,000,000 (estimated). The earthquake at Valparaiso (Chile), August 16, 1906, resulted in the death of 1,500 persons; property loss amounted to $100,000,000. The Kingston (Jamaica) earthquake of January 14, 1907 resulted in death to 1,100 persons and injuries to 2,000; 6,000 buildings were destroyed the entire property loss being about $25,000,000. 1,500 lives were lost in the earthquake at Cartago (Costa Rica) on May 5, 1910.

POPULATION OF THE UNITED STATES AT EACH CENSUS, 1790 TO 1910: By States and Geographic Divisions.

[Source: Reports of the Bureau of the Census, Department of Commerce and Labor.]

State.	1790	1800	1810	1820	1830	1840	1850	1860	1870	1880	1890	1900	1910
Alabama				127,901	309,527	590,756	771,623	964,201	996,992	1,262,505	1,513,401	1,828,697	2,138,093
Arizona									9,658	40,440	88,243	122,931	204,354
Arkansas			1,062	14,273	30,388	97,574	209,897	435,450	484,471	802,525	1,128,211	1,311,564	1,574,449
California							92,597	379,994	560,247	864,694	1,213,398	1,485,053	2,377,549
Colorado								34,277	39,864	194,327	413,249	539,700	799,024
Connecticut	237,946	251,002	261,942	275,248	297,675	309,978	370,792	460,147	537,454	622,700	746,258	908,420	1,114,756
Delaware	59,096	64,273	72,674	72,749	76,748	78,085	91,532	112,216	125,015	146,608	168,493	184,735	202,322
District of Columbia		14,093	24,023	33,039	39,834	43,712	51,687	75,080	131,700	177,624	230,392	278,718	331,069
Florida					34,730	54,477	87,445	140,424	187,748	269,493	391,422	528,542	752,619
Georgia	82,548	162,686	252,433	340,989	516,823	691,392	906,185	1,057,286	1,184,109	1,542,180	1,837,353	2,216,331	2,609,121
Idaho									14,999	32,610	88,548	161,772	325,594
Illinois			12,282	55,211	157,445	476,183	851,470	1,711,951	2,539,891	3,077,871	3,826,352	4,821,550	5,638,591
Indiana		5,641	24,520	147,178	343,031	685,866	988,416	1,350,428	1,680,637	1,978,301	2,192,404	2,516,462	2,700,876
Iowa						43,112	192,214	674,913	1,194,020	1,624,615	1,912,297	2,231,853	2,224,771
Kansas								107,206	364,399	996,096	1,428,108	1,470,495	1,690,949
Kentucky	73,677	220,955	406,511	564,317	687,917	779,828	982,405	1,155,684	1,321,011	1,648,690	1,858,635	2,147,174	2,289,905
Louisiana			76,556	153,407	215,739	352,411	517,762	708,002	726,915	939,946	1,118,588	1,381,625	1,656,388
Maine	96,540	151,719	228,705	298,335	399,455	501,793	583,169	628,279	626,915	648,936	661,086	694,466	742,371
Maryland	319,728	341,548	380,546	407,350	447,040	470,019	583,034	687,049	780,894	934,943	1,042,390	1,188,044	1,295,346
Massachusetts	378,787	422,845	472,040	523,287	610,408	737,699	994,514	1,231,066	1,457,351	1,783,085	2,238,947	2,805,346	3,366,416
Michigan			4,762	8,896	31,639	212,267	397,654	749,113	1,184,059	1,636,937	2,093,890	2,420,982	2,810,173
Minnesota							6,077	172,023	439,706	780,773	1,310,283	1,751,394	2,075,708
Mississippi		8,850	40,352	75,448	136,621	375,651	606,526	791,305	827,922	1,131,597	1,289,600	1,551,270	1,797,114
Missouri			19,783	66,586	140,455	383,702	682,044	1,182,012	1,721,295	2,168,380	2,679,185	3,106,665	3,293,335
Montana									20,595	39,159	142,924	243,329	376,053
Nebraska								28,841	122,993	452,402	1,062,656	1,066,300	1,192,214
Nevada								6,857	42,491	62,266	47,355	42,335	81,875
New Hampshire	141,885	183,858	214,460	244,161	269,328	284,574	317,976	326,073	318,300	346,991	376,530	411,588	430,572
New Jersey	184,139	211,149	245,562	277,575	320,823	373,306	489,555	672,035	906,096	1,131,116	1,444,933	1,883,669	2,537,167
New Mexico							61,547	93,516	91,874	119,565	160,282	195,310	327,301
New York	340,120	589,051	959,049	1,372,812	1,918,608	2,428,921	3,097,394	3,880,735	4,382,759	5,082,871	6,003,174	7,268,894	9,113,614
North Carolina	393,751	478,103	555,500	638,829	737,987	753,419	869,039	992,622	1,071,361	1,399,750	1,617,949	1,893,810	2,206,287
North Dakota								[1]	[2]	[2]	190,983	319,146	577,056
Ohio		45,365	230,760	581,434	937,903	1,519,467	1,980,329	2,339,511	2,665,260	3,198,062	3,672,329	4,157,545	4,767,121
Oklahoma											[3] 258,657	[3] 790,391	1,657,155

Oregon							13,294	52,465	90,923	174,768	317,704	413,536	672,765
Pennsylvania	434,373	602,365	810,091	1,049,458	1,348,233	1,724,033	2,311,786	2,906,215	3,521,951	4,282,891	5,258,113	6,302,115	7,665,111
Rhode Island	68,825	69,122	76,931	83,059	97,199	108,830	147,545	174,620	217,353	276,531	345,506	428,556	542,610
South Carolina	249,073	345,591	415,115	502,741	581,185	594,398	668,507	703,708	705,606	995,577	1,151,149	1,340,316	1,515,400
South Dakota								[4] 4,837	[3] 14,181	[2] 135,177	348,600	401,570	583,888
Tennessee	35,691	105,602	261,727	422,823	681,904	829,210	1,002,717	1,109,801	1,258,520	1,542,359	1,767,518	2,020,616	2,184,789
Texas							212,592	604,215	818,579	1,591,749	2,235,527	3,048,710	3,896,542
Utah							11,380	40,273	86,786	143,963	210,779	276,749	373,351
Vermont	85,425	154,465	217,895	235,981	280,652	291,948	314,120	315,098	330,551	332,286	332,422	343,641	355,956
Virginia	747,610	880,200	974,600	1,065,366	1,211,405	1,239,797	1,421,661	1,596,318	1,225,163	1,512,565	1,655,980	1,854,184	2,061,612
Washington													
West Virginia								11,594	23,955	75,116	357,232	518,103	1,141,990
Wisconsin									442,014	618,457	762,794	958,800	1,221,119
Wyoming						30,945	305,391	775,881	1,054,670	1,315,497	1,693,330	2,069,042	2,333,860
									9,118	20,789	62,555	92,531	145,965
Total	3,929,214	5,308,483	7,239,881	9,638,453	12,866,020	17,069,453	23,191,876	31,443,321	38,558,371	50,155,783	[62]947,714	75,994,575	91,972,266
Geographic divisions.[5]													
New England	1,009,408	1,233,011	1,471,973	1,660,071	1,954,717	2,234,822	2,728,116	3,135,283	3,457,924	4,010,529	4,700,749	5,592,017	6,552,681
Middle Atlantic	958,632	1,402,565	2,014,702	2,699,845	3,587,664	4,526,260	5,898,735	7,458,985	8,810,806	10,496,878	12,706,220	15,454,678	19,315,892
East North Central		51,006	272,324	792,719	1,470,018	2,924,728	4,523,260	6,926,884	9,124,517	11,206,668	13,478,305	15,985,581	18,250,621
West North Central			19,783	66,586	140,455	426,814	880,335	2,169,832	3,856,594	6,157,443	8,932,112	10,347,423	11,637,921
South Atlantic	1,851,806	2,286,494	2,674,891	3,061,063	3,645,752	3,925,299	4,679,090	5,364,703	5,853,610	7,597,197	8,857,922	10,443,480	12,194,895
East South Central	109,368	335,407	708,590	1,190,489	1,815,969	2,575,445	3,363,271	4,020,991	4,404,445	5,585,151	6,429,154	7,547,757	8,409,901
West South Central			77,618	167,680	246,127	449,985	940,251	1,747,667	2,029,965	3,334,220	4,740,983	6,532,290	8,784,534
Mountain							72,927	174,923	315,385	[6] 653,119	1,213,935	1,674,657	2,633,517
Pacific							105,891	444,053	675,125	1,114,578	1,888,334	2,416,692	4,192,304
Alaska										[6] 33,426	32,052	63,592	64,356
Hawaii											[7] 89,990	154,001	191,909
Porto Rico												[8] 953,243	1,118,012
Military and naval[9]					[10] 5,318	[10] 6,100						91,219	55,608
Grand total	3,929,214	5,308,483	7,239,881	9,638,453	12,871,338	17,075,553	23,191,876	31,443,321	38,558,371	50,189,209	63,069,756	77,256,630	93,402,151

[1] Dakota Territory.
[2] Population for that part of Dakota Territory taken to form North Dakota: 1880, 36,909; 1870, 2,405; and for that part taken to form South Dakota: 1880, 98,268; 1870, 11,776.
[3] Includes population of Indian Territory: 1890, 180,182; 1900, 392,060.
[4] Includes population (325,462) of Indian Territory and Indian reservations specially enumerated in 1890, but not included in the general report on population in 1890.
[5] For States included in each division, see note 5, p. 38.
[6] Alaska was specially enumerated under the law, but the population was not included in the general report on population in 1880.
[7] According to the census taken as of Dec. 28, 1890, under the direction of the Hawaiian Government.
[8] According to the census of Porto Rico taken in 1899 under the direction of the War Department.
[9] Persons in the military and naval service of the United States (including civilian employees, etc.) stationed abroad, not credited to any State or Territory.
[10] Persons on public ships in the service of the United States not credited to any State or Territory, but included in the total for continental United States.

POPULATION IN 1910: By Sex, Race, and Nativity and Parentage of Whites, and by States and Geographic Divisions.

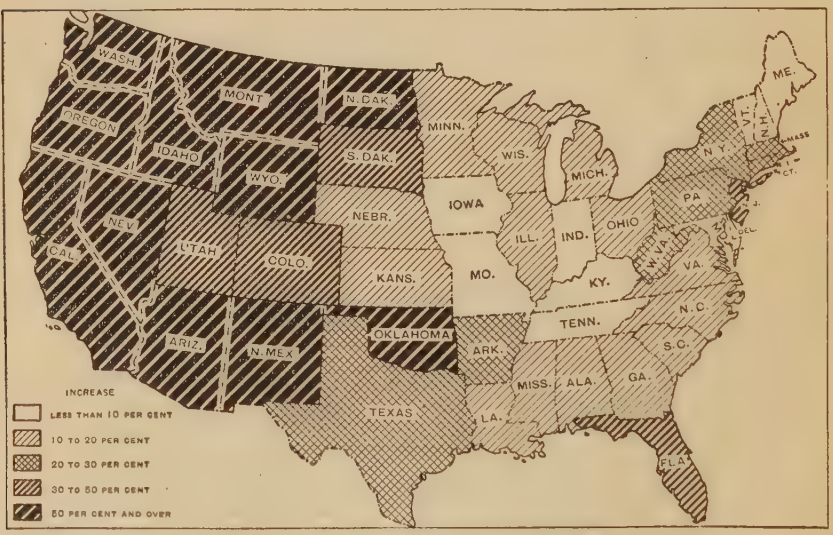
[Source: Report of the Bureau of the Census, Department of Commerce and Labor. Figures are preliminary and are subject to revision.]

State.	Sex.		Race, nativity, and parentage.							
	Male.	Female.	Native white of native parentage.	Native white of foreign parentage.	Foreign white.	Negro.	Indian.	Chinese.	Japanese.	All other.
Alabama	1,074,209	1,063,884	1,177,457	32,438	18,946	908,275	909	61	3	4
Arizona	118,582	85,772	82,480	42,175	46,844	2,067	29,201	1,236	351	.....
Arkansas	810,025	764,424	1,077,509	36,608	16,913	442,891	460	59	8	1
California	1,322,973	1,054,576	1,106,533	635,970	517,319	21,645	16,371	36,197	41,324	2,190
Colorado	430,697	368,327	475,136	181,432	126,971	11,453	1,482	360	2,190	.....
Connecticut	563,641	551,115	395,649	374,546	328,737	15,174	152	427	71	.....
Delaware	103,435	98,887	127,809	25,873	17,421	31,181	5	29	4	.....
District of Columbia	158,050	173,019	166,711	45,066	24,351	94,446	68	369	47	11
Florida	394,166	358,453	373,967	35,828	33,851	308,669	74	184	45	1
Georgia	1,305,019	1,304,102	1,391,058	25,677	15,081	1,176,987	95	219	4	.....
Idaho	185,546	140,048	203,604	75,254	40,444	646	3,488	838	1,308	12
Illinois	2,911,653	2,726,938	2,600,565	1,724,489	1,201,928	109,041	188	2,104	276	.....
Indiana	1,383,299	1,317,577	2,130,168	350,747	159,118	60,280	279	249	35	.....
Iowa	1,148,171	1,076,600	1,303,526	632,182	273,388	15,078	471	93	30	3
Kansas	885,912	805,037	1,207,087	292,077	134,719	54,504	2,444	15	103	.....
Kentucky	1,161,709	1,128,196	1,863,157	124,775	40,023	261,656	234	50	10	.....
Louisiana	835,275	821,113	776,569	112,728	51,828	713,874	780	493	31	85
Maine	377,053	365,318	494,918	135,188	109,911	1,364	892	90	8	.....
Maryland	644,225	651,121	766,628	191,841	104,176	232,249	55	374	23	.....
Massachusetts	1,655,226	1,711,190	1,103,361	1,170,793	1,050,899	38,042	688	2,493	140	.....
Michigan	1,454,534	1,355,639	1,224,841	965,217	595,200	17,115	7,519	239	40	2
Minnesota	1,108,511	967,197	575,081	941,315	542,857	7,084	9,053	250	66	2
Mississippi	905,761	891,353	757,233	19,495	9,391	1,009,487	1,253	249	2	4
Missouri	1,687,838	1,605,497	2,387,909	518,341	228,695	157,452	313	532	91	2
Montana	226,866	149,187	162,129	106,811	91,647	1,834	10,745	1,276	1,593	18
Nebraska	627,782	564,432	642,075	362,353	175,883	7,689	3,502	109	574	29

Nevada	52,551	29,324	35,313	20,956	18,102	513	5,240	900	839	12
New Hampshire	216,290	214,282	230,231	103,118	96,560	564	34	64	1	.....
New Jersey	1,286,463	1,250,704	1,009,909	777,859	658,159	89,760	168	1,109	203	.....
New Mexico	175,245	152,056	255,609	26,331	22,662	1,628	20,573	246	252	.....
New York	4,584,581	4,529,033	3,230,154	3,007,507	2,729,260	134,181	6,046	5,235	1,217	14
North Carolina	1,098,471	1,107,816	1,485,705	8,855	5,953	697,843	7,851	78	2	.....
North Dakota	317,554	259,502	162,461	251,256	156,138	617	6,486	39	59	.....
Ohio	2,434,765	2,332,356	3,033,275	1,024,377	597,255	111,443	127	574	70	.....
Oklahoma	881,573	775,582	1,310,405	94,044	40,088	137,612	74,825	137	46	.....
Oregon	384,255	288,510	416,851	135,241	103,002	1,519	5,090	7,359	3,418	285
Pennsylvania	3,942,137	3,722,974	4,222,616	1,806,392	1,438,752	193,908	1,503	1,749	189	2
Rhode Island	270,359	272,251	159,821	194,646	178,031	9,529	284	266	33	.....
South Carolina	751,842	763,558	661,970	11,138	6,054	835,843	331	56	8	.....
South Dakota	317,101	266,787	245,665	217,478	100,628	817	19,137	120	43	.....
Tennessee	1,103,491	1,081,298	1,654,606	38,367	18,460	473,088	216	43	8	1
Texas	2,017,612	1,878,930	2,602,958	361,026	240,012	690,020	702	575	341	8
Utah	196,857	176,494	171,671	131,527	63,404	1,143	3,123	373	2,105	5
Vermont	182,568	173,388	229,382	75,055	49,861	1,621	26	8	3	.....
Virginia	1,035,348	1,026,264	1,325,238	37,943	26,628	671,096	539	154	14	.....
Washington	658,650	483,340	585,401	282,529	241,227	6,058	10,997	2,706	12,886	186
West Virginia	644,044	577,075	1,042,107	57,638	57,072	64,173	36	90	3	.....
Wisconsin	1,208,541	1,125,319	763,224	1,044,764	512,569	2,900	10,142	224	34	3
Wyoming	91,666	54,299	80,711	32,497	27,165	2,235	1,486	244	1,571	56
Total	47,332,122	44,640,144	49,488,441	18,900,663	13,343,583	9,828,294	265,683	70,944	71,722	2,936
Geographic divisions.[1]										
New England	3,265,137	3,287,544	2,613,362	2,053,346	1,813,999	66,294	2,076	3,348	256	.....
Middle Atlantic	9,813,181	9,502,711	8,462,679	5,591,758	4,826,171	417,849	7,717	8,093	1,609	16
East North Central	9,392,792	8,857,829	9,752,073	5,109,594	3,066,070	300,779	18,255	3,390	455	5
West North Central	6,092,869	5,545,052	6,523,804	3,215,002	1,612,308	243,241	41,406	1,158	966	36
South Atlantic	6,134,600	6,060,295	7,341,193	439,859	290,587	4,112,487	9,054	1,553	150	12
East South Central	4,245,170	4,164,731	5,452,453	215,075	86,820	2,652,506	2,612	403	23	9
West South Central	4,544,485	4,240,049	5,767,439	605,306	348,841	1,984,397	76,767	1,264	426	94
Mountain	1,478,010	1,155,507	1,466,653	616,983	437,239	21,519	75,338	5,473	10,209	103
Pacific	2,365,878	1,826,426	2,108,785	1,053,740	861,548	29,222	32,458	46,262	57,628	2,661

CENTRE OF POPULATION.

At the time of the first census, the centre of population was 23 miles east of Baltimore, Maryland, since which time it has moved steadily westward. In 1800 it was 18 miles west of Baltimore, in 1810 40 miles northwest by west from Washington, D. C.; in 1820 16 miles north of Woodstock, Va.; in 1830 19 miles west-southwest of Moorefield, W. Va.; in 1840 16 miles south of Clarksburg, W. Va.; in 1850 23 miles southwest of Parkersburg, W. Va.; in 1860 20 miles south of Chillicothe, Ohio; in 1870 48 miles east by north of Cincinnati, Ohio; in 1890 20 miles east of Columbus, Indiana; in 1900 6 miles southeast of Columbus, Indiana; and finally, in 1910 in the city of Bloomington, Indiana. During the 120 years that the United States has existed the centre has moved over 550 miles westward, or in other words, from west latitude 76 degrees 11 minutes 12 seconds to west latitude 86 degrees 32 minutes 20 seconds.



PERCENTAGE OF INCREASE BY STATES 1900–1910.

INCREASE IN POPULATION.

CENSUS YEAR.	Population of continental United States.	INCREASE OVER PRECEDING CENSUS.		Adjusted percentages of increase.
		Number.	Per cent.	
1910	91,972,266	15,977,691	21.0	21.0
1900	75,994,575	13,046,861	20.7	20.7
1890	62,947,714	12,791,931	25.5	24.9
1880	50,155,783	11,597,412	30.1	26.0
1870	38,558,371	7,115,050	22.6	26.6
1860	31,443,321	8,251,445	35.6	35.6
1850	23,191,876	6,122,423	35.9	35.9
1840	17,069,453	4,203,433	32.7	32.7
1830	12,866,020	3,227,567	33.5	33.5
1820	9,638,453	2,398,572	33.1	33.1
1810	7,239,881	1,931,398	36.4	36.4
1800	5,308,483	1,379,269	35.1	35.1
1790	3,929,214			

POPULATION OF CITIES

OF THE

UNITED STATES

Census of 1910

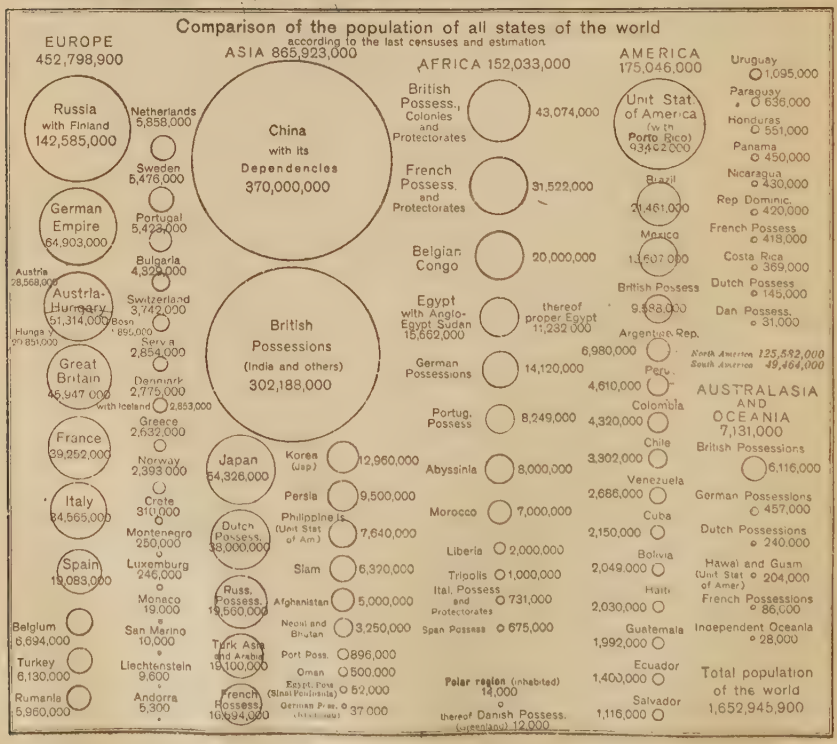
Cities of over 100,000 population

Albany, N. Y....	100,253	Indianapolis, Ind.	233,650	Philadelphia, Pa.	1,549,008
Atlanta, Ga.....	154,839	Jersey City, N. J.	267,779	Pittsburgh, Pa...	533,905
Baltimore, Md ..	558,485	Kansas City, Mo.	248,381	Portland, Ore....	207,214
Birmingham, Ala.	132,685	Los Angeles, Cal.	319,198	Providence, R. I.	224,326
Boston, Mass....	670,585	Louisville, Ky...	223,928	Richmond, Va...	127,628
Bridgeport, Conn	102,054	Lowell, Mass....	106,294	Rochester, N. Y..	218,149
Buffalo, N. Y....	423,715	Memphis, Tenn..	131,105	St. Louis, Mo....	687,029
Cambridge, Mass	104,839	Milwaukee, Wis..	373,857	St. Paul, Minn...	214,744
Chicago, Ill.....	2,185,283	Minneapolis, Minn.....	301,408	San Francisco, Cal.....	416 912
Cincinnati, Ohio.	364,463	Nashville, Tenn..	110,364	Scranton, Pa....	129,867
Cleveland, Ohio..	560,663	Newark, N. J....	347,469	Seattle, Wash....	237,194
Columbus, Ohio..	181,548	New Haven, Ct..	133,605	Spokane, Wash..	104,402
Dayton, Ohio....	116,577	New Orleans, La.	339,075	Syracuse, N. Y...	137,249
Denver, Colo....	213,381	New York, N. Y.	4,766,883	Toledo, Ohio....	168,497
Detroit, Mich....	465,766	Oakland, Cal....	150,174	Washington, D. C.	331,069
Fall River, Mass.	119,295	Omaha, Neb.....	124,096	Worcester, Mass.	145,986
Grand Rapids, Mich.....	112,571	Paterson, N. J...	125,600		

Cities of from 25,000 to 100,000 population

Akron, Ohio.....	69,067	Decatur, Ill.....	31,140	Kansas City, Kans..	82,331
Allentown, Pa.....	51,913	Des Moines, Iowa...	86,368	Kingston, N. Y.....	25,908
Altoona, Pa.....	52,127	Dubuque, Iowa.....	38,494	Knoxville, Tenn....	36,346
Amsterdam, N. Y...	31,267	Duluth, Minn.....	78,466	La Crosse, Wis.....	30,417
Atlantic City, N. J..	46,150	Easton, Pa.....	28,523	Lancaster, Pa.....	47,227
Auburn, N. Y.....	34,668	East Orange, N. J....	34,371	Lansing, Mich.....	31,229
Augusta, Ga.....	41,040	East St. Louis, Ill...	58,547	Lawrence, Mass.....	85,892
Aurora, Ill.....	29,807	El Paso, Tex.....	39,279	Lewiston, Me.....	26,247
Austin, Tex.....	29,860	Elgin, Ill.....	25,976	Lexington, Ky.....	35,099
Battle Creek, Mich..	25,267	Elizabeth, N. J.....	73,409	Lima, Ohio.....	30,508
Bay City, Mich,....	45,166	Elmira, N. Y.....	37,176	Lincoln, Nebr.....	43,973
Bayonne, N. J.....	55,545	Erie, Pa.....	66,525	Little Rock, Ark....	45,941
Berkeley, Cal.....	40,434	Evansville, Ind.....	69,647	Lorain, Ohio.....	28,883
Binghamton, N. Y..	48,443	Everett, Mass.....	33,484	Lynchburg, Va.....	29,494
Bloomington, Ill....	25,768	Fitchburg, Mass....	37,826	Lynn, Mass.....	89,336
Brockton, Mass.....	56,878	Flint, Mich.....	38,550	Macon, Ga.....	40,665
Brookline, Mass....	27,792	Fort Wayne, Ind....	63,933	McKeesport, Pa....	42,694
Butte, Mont.....	39,165	Fort Worth, Tex....	73,312	Madison, Wis.....	25,531
Camden, N. J.....	94,538	Galveston, Tex.....	36,981	Malden, Mass.....	44,404
Canton, Ohio.....	50,217	Green Bay, Wis.....	25,236	Manchester, N. H...	70,063
Cedar Rapids, Iowa.	32,811	Hamilton, Ohio.....	35,279	Meriden, Conn.....	27,265
Charleston, S. C....	58,833	Harrisburg, Pa.....	64,186	Mobile, Ala.....	51,521
Charlotte, N. C.....	34,014	Hartford, Conn.....	98,915	Montgomery, Ala...	38,136
Chattanooga, Tenn.	44,604	Haverhill, Mass.....	44,115	Mount Vernon, N. Y	30,919
Chelsea, Mass.....	32,452	Hazleton, Pa.....	25,452	Muskogee, Okla.....	25,278
Chester, Pa.....	38,537	Hoboken, N. J.....	70,324	Nashua, N. H.....	26,005
Chicopee, Mass.....	25,401	Holyoke, Mass.....	57,730	Newark, Ohio.....	25,404
Clinton, Iowa.....	25,577	Houston, Tex.....	78,800	New Bedford, Mass.	96,652
Colorado Springs Colo.....	29,078	Huntington, W. Va..	31,161	New Britain, Conn..	43,916
Columbia, S. C.....	26,319	Jackson, Mich.....	31,433	Newburgh, N. Y....	27,805
Council Bluffs, Iowa.	29,292	Jacksonville, Fla....	57,699	Newcastle, Pa.....	36,280
Covington, Ky.....	53,270	Jamestown, N. Y....	31,297	Newport, Ky.....	30,309
Dallas, Tex.....	92,104	Johnstown, Pa.....	55,482	Newport, R. I.....	27,149
Danville, Ill.....	27,871	Joliet, Ill.....	34,670	New Rochelle, N. Y.	28,867
Davenport, Iowa....	43,028	Joplin, Mo.....	32,073	Newton, Mass . . .	39,806
		Kalamazoo, Mich...	39,437	Niagara Falls, N. Y..	30,445

Norfolk, Va..... 67,452	St. Joseph, Mo..... 77,403	Terre Haute, Ind.... 58,157
Norristown, Pa..... 27,875	Salem, Mass..... 43,697	Topeka, Kans..... 43,684
Ogden, Utah..... 25,580	Salt Lake City, Utah 92,777	Trenton, N. J..... 96,815
Oklahoma City, Okla 64,205	San Antonio, Tex... 96,614	Troy, N. Y..... 76,813
Orange, N. J..... 29,630	San Diego, Cal..... 39,578	Utica, N. Y..... 74,419
Oshkosh, Wis..... 33,062	San Jose, Cal..... 28,946	Waco, Tex..... 26,425
Pasadena, Cal..... 30,291	Savannah, Ga..... 65,064	Waltham, Mass..... 27,834
Passaic, N. J..... 54,773	Schenectady, N. Y.. 72,826	Warwick, R. I..... 26,629
Pawtucket, R. I..... 51,622	Sheboygan, Wis..... 26,398	Waterbury, Conn... 73,141
Peoria, Ill..... 66,950	Shenandoah, Pa..... 25,774	Waterloo, Iowa..... 26,693
Perth Amboy, N. J.. 32,121	Shreveport, La..... 28,015	Watertown, N. Y... 26,730
Pittsfield, Mass..... 32,121	Sioux City, Iowa.... 47,828	West Hoboken, N. J. 35,403
Portland, Me..... 58,571	Somerville, Mass.... 77,236	Wheeling, W. Va.... 41,641
Portsmouth, Va..... 33,190	South Bend, Ind.... 53,684	Wichita, Kans..... 52,450
Poughkeepsie, N. Y. 27,936	South Omaha, Nebr. 26,259	Wilkes-Barre, Pa.... 67,105
Pueblo Colo..... 44,395	Springfield, Ill.... 51,678	Williamsport, Pa.... 31,860
Quincy, Ill..... 36,587	Springfield, Mass.... 88,926	Wilmington, Del.... 87,411
Quincy, Mass..... 32,642	Springfield, Mo.... 35,201	Wilmington, N. C... 25,748
Racine, Wis..... 38,002	Springfield, Ohio... 46,921	Woonsocket, R. I... 38,125
Reading, Pa..... 96,071	Stamford, Conn..... 25,138	Yonkers, N. Y..... 79,803
Roanoke, Va..... 34,874	Superior, Wis..... 40,384	York, Pa..... 44,750
Rockford, Ill..... 45,401	Tacoma, Wash..... 83,743	Youngstown, Ohio.. 79,066
Sacramento, Cal.... 44,696	Tampa, Fla..... 37,782	Zanesville, Ohio.... 28,026
Saginaw, Mich..... 50,510	Taunton, Mass..... 34,259	



POPULATION OF URBAN AND RURAL TERRITORY.

CLASS OF PLACES.	1910		1900		1890		PER CENT OF TOTAL POPULATION.		
	Number of places.	Population.	Number of places.	Population.	Number of places.	Population.	1910	1900	1890
Total population of continental United States	.....	91,972,266	.....	75,994,575	.....	62,947,714	100.0	100.0	100.0
Urban territory	**2,405**	**42,623,383**	**1,894**	**30,797,185**	**1,510**	**22,720,223**	**46.3**	**40.5**	**36.1**
Places of 1,000,000 inhabitants or more	3	8,501,174	3	6,429,474	3	3,662,115	9.2	8.5	5.8
Places of 500,000 to 1,000,000 inhabitants	5	3,010,667	3	1,645,087	1	806,343	3.3	2.2	1.3
Places of 250,000 to 500,000 inhabitants	11	3,949,839	9	2,861,296	7	2,447,608	4.3	3.8	3.9
Places of 100,000 to 250,000 inhabitants	31	4,840,458	23	3,272,490	17	2,781,894	5.3	4.3	4.4
Places of 50,000 to 100,000 inhabitants	59	4,178,915	41	2,760,477	30	2,027,569	4.5	3.6	3.2
Places of 25,000 to 50,000 inhabitants	120	4,062,763	82	2,785,667	67	2,298,765	4.4	3.7	3.7
Places of 10,000 to 25,000 inhabitants	374	5,609,208	286	4,409,900	232	3,487,139	6.1	5.8	5.5
Places of 5,000 to 10,000 inhabitants	629	4,364,703	477	3,278,518	361	2,495,594	4.7	4.3	4.0
Places of 2,500 to 5,000 inhabitants	1,173	4,105,656	970	3,354,276	792	2,713,196	4.5	4.4	4.3
Rural territory	.....	**49,348,883**	.....	**45,197,390**	.....	**40,227,491**	**53.7**	**59.5**	**63.9**
Incorporated places of less than 2,500 inhabitants	11,784	8,119,528	8,892	6,247,645	6,466	4,719,835	8.8	8.2	7.5
Other rural territory	.....	41,229,355	.....	38,949,745	.....	35,507,656	44.8	51.3	56.4

VOTING AMERICANS.

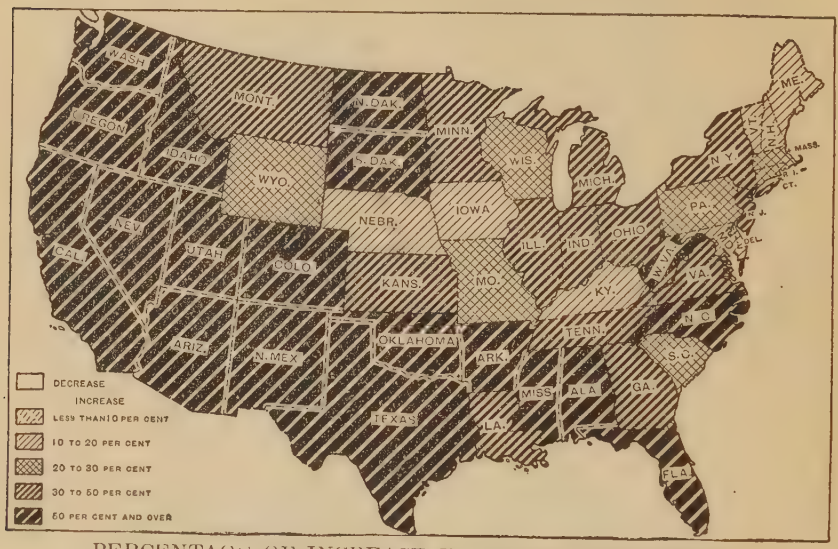
In 1910 the number of males of voting age in continental United States was 26,999,151, or 29.4 per cent. of the total population, as compared with 21,134,299, or 27.8 per cent. of the total population in 1900. Of these 13,211,731 were of native-born white parentage; 4,498,966 native white of foreign or mixed parentage; 3,035,333 of naturalized, foreign-born white population; 570,588, foreign-born white, of parents who had taken out their first papers; 2,265,121 of alien, foreign-born white population; 775,564 of other foreign-born white parentage; 2,459,327 of negro parentage; and 182,521 of all other parentage, inclusive of Indians, Chinese, Japanese, and other Asiatics.

WOMAN SUFFRAGE IN THE UNITED STATES.

In the United States women enjoy suffrage on equal terms with men at all elections in six states, as follows: Wyoming, established in 1869; Colorado, in 1893; Utah, in 1896; Idaho, in 1896; Washington, in 1910 and California, in 1911. Besides the school suffrage, which prevails in some form in 30 states, taxpaying women have been granted the right to vote as follows: In Montana, Louisiana and Michigan, on questions submitted to taxpayers, with a proxy vote permitted in Louisiana; in Iowa and Kansas, on the question of issuing bonds; in Minnesota, equal suffrage on the election of library trustees; in Kansas, municipal suffrage; in New York, on local taxation.

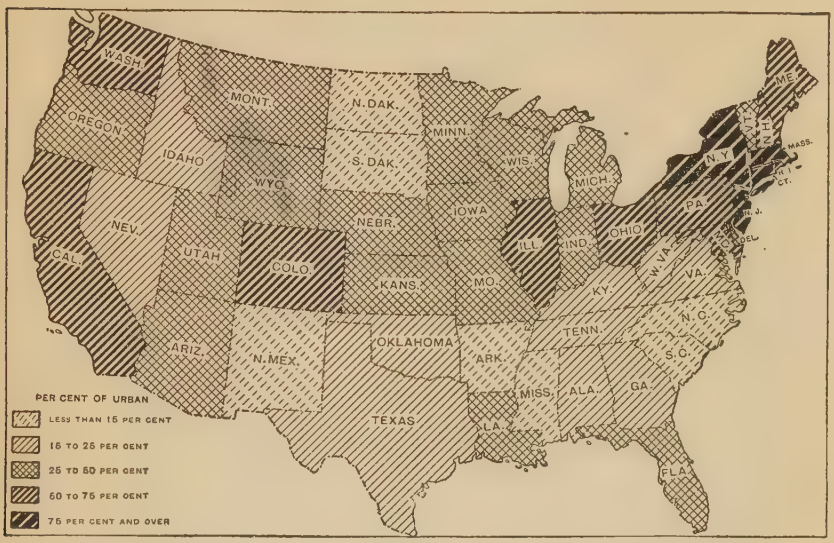
CHRISTIAN ASSOCIATIONS.

The Young Men's Christian Association was organized in England in 1821 by Sir George Williams; the movement has spread to America, Germany, Denmark, Norway, Switzerland, and even China and Japan. In 1911 there were 2,118 associations in North America, with a membership of 536,037; total net property, $67,539,475; number of employed officers, 3,351; students in educational classes, 61,904; 648 gymnasiums; 159,855 enrolled in gymnasiums; 172 athletic fields; 235 railroad associations with 86,091 members; 767 student associations with 62,026 members; boy membership, 103,570. There were also in 1911, 196 city associations for women, 667 student and 12 industrial and rural associations with a total membership of 228,757 young women.



PERCENTAGE OF INCREASE IN URBAN POPULATION: 1900–1910.

PERCENTAGE OF INCREASE IN RURAL POPULATION: 1900–1910.



PERCENTAGE OF URBAN IN TOTAL POPULATION IN 1910.

COLOR, NATIVITY AND PARENTAGE OF POPULATION, FOR PRINCIPAL CITIES OF THE UNITED STATES.

There are in all 229 cities which had in 1910 more than 25,000 inhabitants, with an aggregate population of 28,543,816. Of the combined population of these cities, native whites of native parentage number 10,149,145, or 35.6 per cent.; native whites of foreign or mixed parentage, 9,219,007, or 32.3 per cent.; foreign-born whites, 7,479,033, or 26.2 per cent.; negroes, 1,625,640, or 5.7 per cent.; all other, 70,991, or 0.2 per cent. For continental United States, as a whole, the equivalent numbers and percentages are: Native whites of native parentage, 49,488,441, or 53.8 per cent; native whites of foreign or mixed parentage 18,900,663, or 20.6 per cent.; foreign-born whites, 13,343,583, or 14.5 per cent.; negroes, 9,828,294, or 10.7 per cent.

The combined population (28,543,816) of the 229 cities taken together constitutes 31 per cent. of the entire population (91,972,266) of continental United States in 1910. In the case, however, of native whites of native parentage, the number in these cities constitutes only 20.5 per cent. of the total number in the United States, while for native whites of foreign or mixed parentage the percentage is 48.8 and for foreign-born whites, 56. For negroes the percentage in the principal cities is 16.5.

The foreign-born white element is mainly concentrated in the Northern and Eastern states, and in many of the cities in these states the proportion of foreign-born whites in the total population is very large. Passaic, N. J., has 28,467 foreign-born whites, representing 52 per cent. of its total population (54,773). This is the largest proportion of foreign-born whites in any of the principal cities, and Lawrence, Mass., with 41,319 foreign-born whites in a total population of 85,892, has the next largest proportion, 48.1 per cent. There are 11 other cities in each of which the foreign-born whites constitute more than 40 per cent. of the total population, namely, Perth Amboy, N. J., 44.5; New Bedford, Mass., 44.1; Woonsocket, R. I., 43.4; Fall River, Mass., 42.6; Chelsea, Mass., 42.4; Manchester, N. H., 42.4; New Britain, Conn., 41; Lowell, Mass., 40.9; Shenandoah, Pa., 40.6; New York, N. Y., 40.4; Holyoke, Mass., 40.3.

Negroes constitute one-fourth or more of the total population in each of 27 principal cities, and in 4 of them the proportion is more than half, namely, Charleston, S. C., 31,05 negroes, or 52.8 per cent.; Savannah, Ga., 33,246, or 51.1 per cent.; Jacksonville, Fla., 29,293 or 50.8 per cent.; Montgomery, Ala., 19,322, or 50.7 per cent.

AREA OF STATES AND TERRITORIES.

[Based upon careful joint calculations made in the General Land Office, the Geological Survey, and the Bureau of the Census.]

States or Territories.	Land surface.		Water surface.		Total areas.	
	Sq. m.	*Acres.*	*Sq. m.*	*Acres.*	*Sq. m.*	*Acres.*
Alabama	51,279	32,818,560	719	460,160	51,998	33,278,720
Arizona	113,810	72,838,400	146	93,440	113,956	72,931,840
Arkansas	52,525	33,616,000	810	518,400	53,335	34,134,400
California	155,652	99,617,280	2,645	1,692,800	158,297	101,310,080
Colorado	103,658	66,341,120	290	185,600	103,948	66,526,720
Connecticut	4,820	3,084,800	145	92,800	4,965	3,177,600
Delaware	1,965	1,257,600	405	259,200	2,370	1,516,800
District of Columbia	60	38,400	10	6,400	70	44,800
Florida	54,861	35,111,040	3,805	2,435,200	58,666	37,546,240
Georgia	58,725	37,584,000	540	345,600	59,265	37,929,600
Idaho	83,354	53,346,560	534	341,760	83,888	53,688,320
Illinois	56,043	35,867,520	622	398,080	56,665	36,265,600
Indiana	35,815	23,068,800	309	197,760	36,354	23,266,560
Iowa	55,586	35,575,040	561	359,040	56,147	35,934,080
Kansas	81,774	52,335,360	384	245,760	82,158	52,581,120
Kentucky	40,181	25,715,840	417	266,880	40,598	25,982,720
Louisiana	45,409	29,061,760	3,097	1,982,080	48,506	31,043,840
Maine	29,895	19,132,800	3,145	2,012,800	33,040	21,145,600
Maryland	9,941	6,362,240	2,386	1,527,040	12,327	7,889,280
Massachusetts	8,039	5,144,960	227	145,280	8,266	5,290,240
Michigan	57,480	36,787,200	500	320,000	57,980	37,107,200
Minnesota	80,858	51,749,120	3,824	2,447,360	84,682	54,196,480
Mississippi	46,362	29,671,680	503	321,920	46,865	29,993,600
Missouri	68,727	43,985,280	693	443,520	69,420	44,428,800
Montana	146,201	93,568,640	796	509,440	146,997	94,078,080
Nebraska	76,808	49,157,120	712	455,680	77,520	49,612,800
Nevada	109,821	70,285,440	869	556,160	110,690	70,841,600
New Hampshire	9,031	5,779,840	310	198,400	9,341	5,978,240
New Jersey	7,514	4,808,960	710	454,400	8,224	5,263,360
New Mexico	122,503	78,401,920	131	83,840	122,634	78,485,760
New York	47,654	30,498,560	1,550	992,000	49,204	31,490,560
North Carolina	48,740	31,193,600	3,686	2,359,040	52,426	33,552,640
North Dakota	70,183	44,917,120	654	418,560	70,837	45,335,680
Ohio	40,740	26,073,600	300	192,000	41,040	26,265,600
Oklahoma	69,414	44,424,960	643	411,520	70,057	44,836,480
Oregon	95,607	61,188,480	1,092	698,880	96,699	61,887,360
Pennsylvania	44,832	28,692,480	294	188,160	45,126	28,880,640
Rhode Island	1,067	682,880	181	115,840	1,248	798,720
South Carolina	30,495	19,516,800	494	316,160	30,989	19,832,960
South Dakota	76,868	49,195,520	747	478,080	77,615	49,673,600
Tennessee	41,687	26,679,680	335	214,400	42,022	26,894,080
Texas	262,398	167,934,720	3,498	2,238,720	265,896	170,173,440
Utah	82,184	52,597,760	2,806	1,795,840	84,990	54,393,600
Vermont	9,124	5,839,360	440	281,600	9,564	6,120,960
Virginia	40,262	25,767,680	2,365	1,513,600	42,627	27,281,280
Washington	66,836	42,775,040	2,291	1,466,240	69,127	44,241,280
West Virginia	24,022	15,374,080	148	94,720	24,170	15,468,800
Wisconsin	55,256	35,363,840	810	518,400	56,066	35,882,240
Wyoming	97,594	62,460,160	320	204,800	97,914	62,664,960
	2,973,890	1,903,289,600	52,899	33,855,360	3,026,789	1,937,144,960
Alaska					590,884	378,165,760
Guam					210	134,400
Hawaii					6,449	4,127,360
Panama Canal strip					474	303,360
Philippine Islands					115,026	73,616,640
Porto Rico					3,435	2,198,400
Tutuila Group, Samoa					77	49,280
Total					3,743,344	2,395,740,160

Owing to their location adjoining the Great Lakes, the States enumerated below contain approximately an additional number of square miles as follows: Illinois, 1,674 square miles of Lake Michigan; Indiana, 230 square miles of Lake Michigan; Michigan, 16,653 square miles of Lake Superior, 12,922 square miles of Lake Michigan, 9,925 square miles of Lake Huron, and 460 square miles of lakes St. Clair and Erie; Minnesota, 2,514 square miles of Lake Superior, New York, 3,140 square miles of lakes Ontario and Erie; Ohio, 3,443 square miles of Lake Erie; Pennsylvania, 891 square miles of Lake Erie; Wisconsin, 2,378 square miles of Lake Superior and 7,500 square miles of Lake Michigan.

In addition to the water areas noted above, California claims jurisdiction over all Pacific waters lying within 3 English miles of her coast; Oregon claims jurisdiction over a similar strip of the Pacific Ocean 1 marine league in width between latitude 42° north and the mouth of the Columbia River; and Texas claims jurisdiction over a strip of Gulf water 3 leagues in width, adjacent to her coast and between the Rio Grande and the Sabine River.

AREA OF THE UNITED STATES BY SIZE OF STATES.

STATE.	Rank in gross area.	AREA IN SQUARE MILES.		
		Gross.	Land.	Water.[1]
Continental United States		**3,026,789**	**2,973,890**	**52,899**
Texas	1	265,896	262,398	3,498
California	2	158,297	155,652	2,645
Montana	3	146,997	146,201	796
New Mexico	4	122,634	122,503	131
Arizona	5	113,956	113,810	146
Nevada	6	110,690	109,821	869
Colorado	7	103,948	103,658	290
Wyoming	8	97,914	97,594	320
Oregon	9	96,699	95,607	1,092
Utah	10	84,990	82,184	2,806
Minnesota	11	84,682	80,858	3,824
Idaho	12	83,888	83,354	534
Kansas	13	82,158	81,774	384
South Dakota	14	77,615	76,868	747
Nebraska	15	77,520	76,808	712
North Dakota	16	70,837	70,183	654
Oklahoma	17	70,057	69,414	643
Missouri	18	69,420	68,727	693
Washington	19	69,127	66,836	2,291
Georgia	20	59,265	58,725	540
Florida	21	58,666	54,861	3,805
Michigan	22	57,980	57,480	500
Illinois	23	56,665	56,043	622
Iowa	24	56,147	55,586	561
Wisconsin	25	56,066	55,256	810
Arkansas	26	53,335	52,525	810
North Carolina	27	52,426	48,740	3,686
Alabama	28	51,998	51,279	719
New York	29	49,204	47,654	1,550
Louisiana	30	48,506	45,409	3,097
Mississippi	31	46,865	46,362	503
Pennsylvania	32	45,126	44,832	294
Virginia	33	42,627	40,262	2,365
Tennessee	34	42,022	41,687	335
Ohio	35	41,040	40,740	300
Kentucky	36	40,598	40,181	417
Indiana	37	36,354	36,045	309
Maine	38	33,040	29,895	3,145
South Carolina	39	30,989	30,495	494
West Virginia	40	24,170	24,022	148
Maryland	41	12,327	9,941	2,386
Vermont	42	9,564	9,124	440
New Hampshire	43	9,341	9,031	310
Massachusetts	44	8,266	8,039	227
New Jersey	45	8,224	7,514	710
Connecticut	46	4,965	4,820	145
Delaware	47	2,370	1,965	405
Rhode Island	48	1,248	1,067	181
District of Columbia	49	70	60	10

[1] Does not include the water surface of the oceans, the Gulf of Mexico, or the Great Lakes, lying within the jurisdiction of the United States.

A census just completed by the Isthmian Canal Commission shows that in 1904 there were 154,255 persons in the Canal Zone. The City of Panama has a population of 35,368, of which 18,237 are Mestizos, 10,963 negroes, 7,968 white, and 1,180 Amarillos or yellows. Colon has 17,748 inhabitants.

POPULATION OF CONTINENTAL UNITED STATES PER SQUARE MILE.

CENSUS YEAR.	Population of continental United States.	Land area in square miles.	Population per square mile.
1910	91,972,266	2,973,890	30.9
1900	75,994,575	2,974,159	25.6
1890	62,947,714	2,973,965	21.2
1880	50,155,783	2,973,965	16.9
1870	38,558,371	2,973,965	13.0
1860	31,443,321	2,973,965	10.6
1850	23,191,876	2,944,337	7.9
1840	17,069,453	1,753,588	9.7
1830	12,866,020	1,753,588	7.3
1820	9,638,453	1,753,588	5.5
1810	7,239,881	1,685,865	4.3
1800	5,308,483	867,980	6.1
1790	3,929,214	867,980	4.5

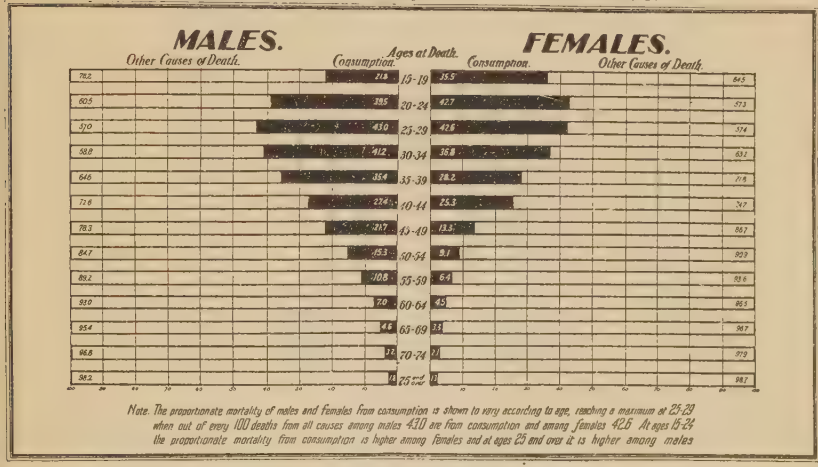
PRISON POPULATION IN 1910.

The prison population of the United States on January 1, 1910 was 113,579; and the number of commitments to prisons or other penal institutions, during the year 1910, was 479,763. These figures include every class of offense, from vagrancy to murder in the first degree. They also include cases in which the offender was committed to jail or prison for the non-payment of a fine. The ratio of prisoners to population on January 1, 1910, was 125 to 100,000, and the ratio of commitments to population during the year 1910 was 522 to 100,000. Thus it appears that, at the beginning of the year 1910, one person out of every 800 in the United States greeted the New Year in jail; and that, during 1910, for every 190 persons in the total population, there was one commitment to prison or jail, for a period ranging from one day to a life sentence.

POPULATION PER SQUARE MILE: 1910.

Mortality from Consumption by Age and Sex.

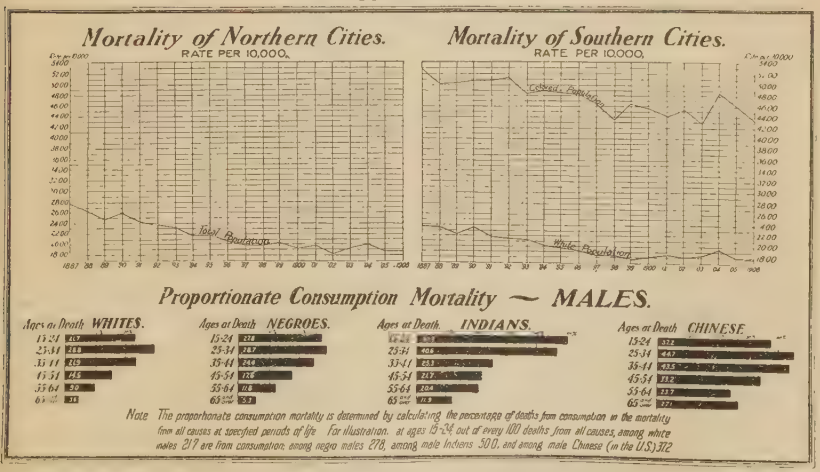
Prudential Industrial Experience ~ 1897-1906.



Note. The proportionate mortality of males and females from consumption is shown to vary according to age, reaching a maximum at 25-29 when out of every 100 deaths from all causes among males 43.0 are from consumption and among females 42.6. At ages 15-24 the proportionate mortality from consumption is higher among females and at ages 25 and over it is higher among males.

Mortality from Consumption ~ *General Population.*

1887-1906.



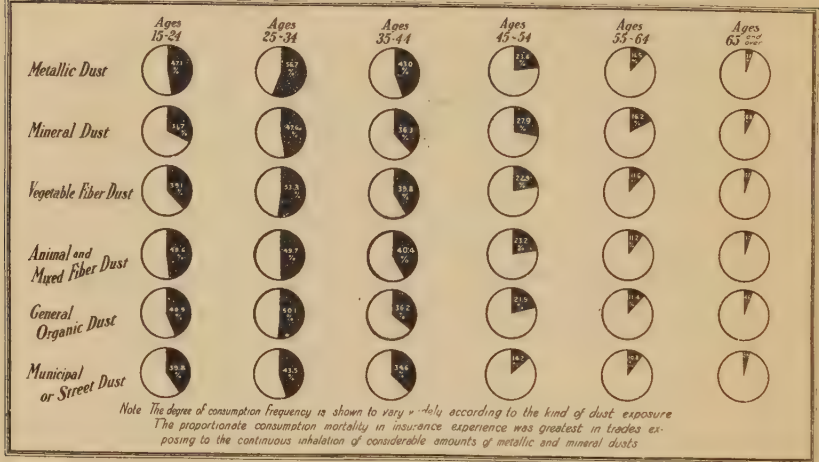
Note. The proportionate consumption mortality is determined by calculating the percentage of deaths from consumption to the mortality from all causes at specified periods of life. For illustration, at ages 15-24 out of every 100 deaths from all causes, among white males 21.7 are from consumption, among negro males 27.8, among male Indians 30.7, and among male Chinese (in the U.S.) 32.5.

INDIANS.

Only eleven of the states in the United States have large Indian populations, namely: Oklahoma with 117,247; Arizona with 39,216; New Mexico with 20,909; South Dakota with 20,352; California with 16,369; Wisconsin with 11,428; Washington with 10,997; Montana with 10,814; Minnesota with 10,711; North Dakota with 8,253; and Michigan with 7,520. The other states of the Union have a total Indian population of 34,097 and rank according to the number of Indian inhabitants as follows: Oregon, New York, Nevada, Nebraska, Wyoming, Kansas, Utah and other states. The total Indian population of the United States is 307,913.

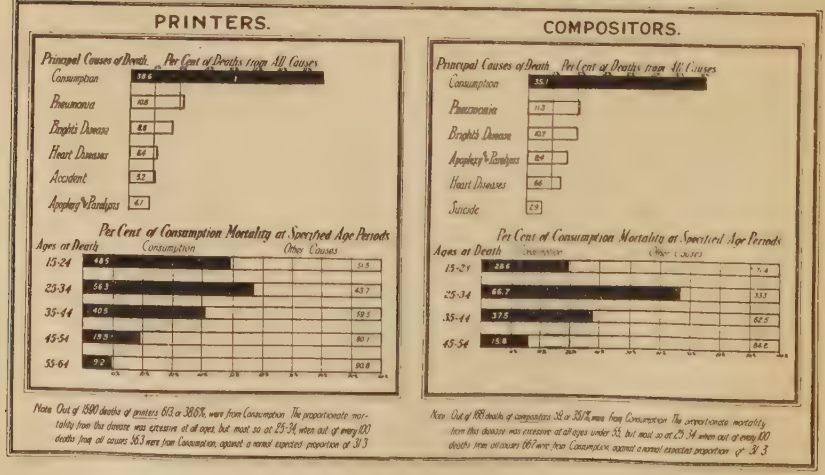
Mortality from Consumption in Dusty Trades.

Prudential Industrial Experience ~ 1897-1906.


Ages 15-24
Ages 25-34
Ages 35-44
Ages 45-54
Ages 55-64
Ages 65 and over
Metallic Dust
Mineral Dust
Vegetable Fiber Dust
Animal and Mixed Fiber Dust
General Organic Dust
Municipal or Street Dust
Note The degree of consumption frequency is shown to very nearly according to the kind of dust exposure
The proportionate consumption mortality in insurance experience was greatest in trades exposing to the continuous inhalation of considerable amounts of metallic and mineral dusts

Mortality from Consumption - *Exposure to Metallic Dust.*

Prudential Industrial Experience ~ 1897-1906.


PRINTERS.
Principal Causes of Death. Per Cent of Deaths from All Causes
Consumption 18.6
Pneumonia 10.8
Bright's Disease 8.8
Heart Diseases 6.4
Accident 5.2
Apoplexy & Paralysis 4.1
Per Cent of Consumption Mortality at Specified Age Periods
Ages at Death
Consumption
Other Causes
15-24 49.5 50.5
25-34 56.3 43.7
35-44 40.5 59.5
45-54 19.3 80.7
55-64 9.2 90.8
Note Out of 1590 deaths of printers 603 or 38.6% were from Consumption The proportionate mortality from this disease was excessive at all ages, but most so at 25-34, when out of every 100 deaths from all causes 56.3 were from Consumption, against a normal expected proportion of 3.3
COMPOSITORS.
Principal Causes of Death Per Cent of Deaths from All Causes
Consumption 35.1
Pneumonia 11.3
Bright's Disease 10.7
Apoplexy & Paralysis 8.4
Heart Diseases 6.6
Suicide 2.9
Per Cent of Consumption Mortality at Specified Age Periods
Ages at Death
15-24 28.6 71.4
25-34 66.7 33.3
35-44 37.5 62.5
45-54 15.8 84.2
Note Out of 188 deaths of compositors 66 or 35.1% were from Consumption The proportionate mortality from this disease was excessive at all ages under 55, but most so at 25-34 when out of every 100 deaths from all causes 66.7 were from Consumption, against a normal expected proportion of 3.3

Recent statistics show that at the end of May, 1910, there were 431 state and local anti-tuberculosis associations, 286 special dispensaries, 393 special sanatoria and hospitals, and 22,720 beds for tuberculosis cases. It was estimated that there were 350,000 indigent consumptives in the United States, in May, 1910, and that it would cost $50,000,000 yearly to take care of them in institutions.

SUICIDES IN ONE HUNDRED AMERICAN CITIES, 1891–1910.

Years.	Population.	Suicides.	Rate per 100,000 Population.
1891	12,818,957	1,727	13.5
1892	13,335,186	1,713	12.8
1893	13,686,566	2,097	15.3
1894	14,038,525	2,139	15.2
1895	14,539,050	2,218	15.3
1896	15,027,676	2,360	15.7
1897	15,416,634	2,583	16.8
1898	15,892,764	2,630	16.5
1899	16,269,285	2,594	15.9
1900	16,753,366	2,728	16.3
1901	17,248,177	2,855	16.6
1902	17,743,001	3,139	17.7
1903	18,237,846	3,513	19.3
1904	18,732,699	3,766	20.1
1905	19,254,249	3,650	19.0
1906	19,837,798	3,537	17.8
1907	20,421,363	3,975	19.5
1908	21,004,936	4,582	21.8
1909	21,588,516	4,537	21.0
1910	22,172,095	4,377	19.7
1891–1895	68,418,284	9,894	14.5
1896–1900	79,359,725	12,895	16.2
1901–1905	91,215,972	16,923	18.6
1906–1910	105,024,708	21,008	20.0

Courtesy of The Spectator.—F. L. Hoffman, Compiler.

During the year 1911 there were 4,460 suicides out of a population of 22,758,471, or equivalent to 19.6 per 100,000 of population. There were also 12,652 business failures, out of 1,514,164 business concerns, or 8.8 business failures per 1,000 existing concerns.

COMPARISON OF SUICIDES AND BUSINESS FAILURES IN THE UNITED STATES, 1891–1910.

Year.	Suicides per 100,000 of Population in 100 American Cities.	Business Failures in the United States per 1,000 Existing Business Concerns. *
1891	13.5	10.7
1892	12.8	8.8
1893	15.3	12.8
1894	15.2	12.5
1895	15.3	10 9
1896	15.7	13.1
1897	16.8	12.6
1898	16.5	11.0
1899	15.9	8.1
1900	16 3	9.2
1901	16.6	9.0
1902	17.7	9.3
1903	19.3	9.4
1904	20.1	9.2
1905	19.0	8.5
1906	17.8	7.7
1907	19.5	8.2
1908	21 8	10 8
1909	21.0	8.0
1910	19.7	8.0

* Furnished by R. G. Dun & Co.

DEATHS.

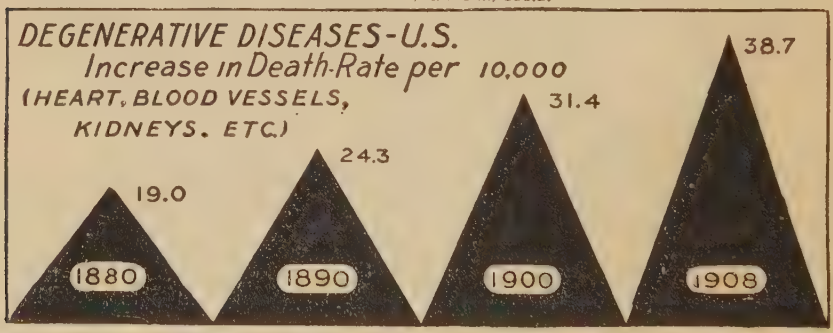
During the year 1910 the total number of deaths in the United States was 805,412, and of this number 753,308, or 935.3 for every thousand deaths, were white. Of this number 546,507 were native born; 281,837 had both parents native born; 201,378 had parents either one or both of which were foreign born. Other deaths among the white population were 196,753 foreign born, and 10,068 unknown. The deaths among the colored population totaling 52,104, or 64.7 for every thousand deaths, were divided as follows: Negro, 49,499; Indian, 886; and Chinese and Japanese 1,719.

Of this number 439,757 were males and 365,655 females. The total number of deaths among children less than a year of age was 154,393; of those from one to five years of age, 62,946; from five to twenty-five, 79,667; from twenty-five to fifty, 174,072; from fifty to seventy-five, 228,691; over seventy-five, 104,875; and of unknown age, 788.

Out of every thousand deaths 191.7 occur before the end of the first year of life; 78.2 between the ages of one and five; 98.8 between the ages of five and twenty-five; 216.1 between the ages of twenty and fifty; 284 between the ages of fifty and seventy-five; 130.3 over seventy-five; and one at an unknown age. Out of every one thousand deaths 546 are males and 454 females.

Dividing the deaths in the United States for the year 1910 according to diseases, we find that 12,673 died of typhoid fever; 1,167 of malaria; smallpox, 202; measles, 6,598; scarlet fever, 6,255; whooping cough, 6,146; diphtheria and croup, 11,521; influenza, 7,774; other epidemic diseases, 6,663; tuberculosis, 86,309; cancer and other malignant tumors, 41,039; diabetes, 8,040; diseases of the nervous system and of the organs of special sense, 77,991; diseases of the circulatory system, 100,106; diseases of the respiratory system, 100,835; diseases of the digestive system, 104,801; non-venereal diseases of the genito-urinary system and annexa, 62,559; from external causes; 8,590, suicide; 45,416, accidental or undefined; 3,190, homicide; and all other causes, 107,537.

The rate of death per hundred thousand population of the more important of these diseases is as follows: typhoid fever, 23.5; tuberculosis, 160.3; cancer and other malignant tumors, 76.2; diseases of the nervous system and of the organs of special sense, 144.8; diseases of the circulatory system, 185.9; diseases of the respiratory system, 187.3; diseases of the digestive system, 194.6; non-venereal diseases of the genito-urinary system and annexa, 116.2.



THE PENALTY OF NEGLECT

The heavy increase in life waste from diseases of the heart, blood vessels, kidneys—apoplexy, etc., demands the attention of the American people. They are over-taxing and neglecting the hardest worked organs of the body, and the penalty is needless disease and premature death for tens of thousands annually. This can only be checked by the adoption of more healthful habits of living and by improvement in hygiene and sanitation.

SUICIDE RECORD OF 1911.

The suicide record of 100 American cities for the year ending 1911 shows a suicide mortality of 4,460 out of a total population for these cities of 22,758,471, or equivalent to 19.6 per 100,000 of population. With only four exceptions this is the highest rate attained during any year since 1892, when the rate was only 12.8. The average suicide rate by quinquennial periods for the last two decades, eliminating fluctuations by single years, has shown a continuous upward tendency, being 14.9 for the first five years, 16.4 during the next five years, and increasing to 18.8 and 20.3 in the succeeding periods. The highest recorded rate for the 100 cities was for San Diego, Cal., in which the rate was 59.9 per 10,0000 of population, against the general average for all the cities of 19.6. A comparison of suicides and business failures for the period 1892–1911 shows that the economic condition of the nation is one of the many factors which determines the degree of suicidal frequency. With 8.8 business failures in 1892, the rate was 12.8, while during the panic years of 1893 and 1907 there was a decided increase in suicides, following the increase in the number of business failures.

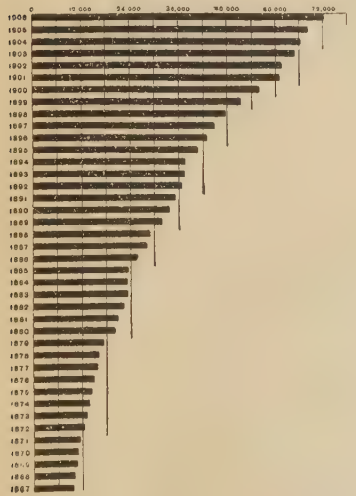
Abstract from article by F. L. Hoffman in "The Spectator," July 11, 1912.

MARRIAGES AND DIVORCES: Number and Increase, Specifying Divorces Granted to Husband or Wife, 1887 to 1906.

[Source: Reports of the Bureau of the Census, Department of Commerce and Labor.]

Calendar year.	Marriages.		Divorces.					
	Number.	Increase over preceding year.	Total number.	Increase over preceding year.	Granted to husband.		Granted to wife.	
					Number.	Per cent.	Number.	Per cent.
1887	483,069	.....	27,919	2,384	9,729	34.8	18,190	65.2
1888	504,530	21,461	28,669	750	10,022	35.0	18,647	65.0
1889	531,457	26,927	31,735	3,066	11,126	35.1	20,609	64.9
1890	542,537	11,080	33,461	1,726	11,625	34.7	21,836	65.3
1891	562,412	19,875	35,540	2,079	12,478	35.1	23,062	64.9
1892	577,870	15,458	36,579	1,039	12,577	34.4	24,002	65.6
1893	578,673	803	37,468	889	12,590	33.6	24,878	66.4
1894	566,161	[1] 12,512	37,568	100	12,551	33.4	25,017	66.6
1895	598,855	32,694	40,387	2,819	13,456	33.3	26,931	66.7
1896	613,873	15,018	42,937	2,550	14,448	33.6	28,489	66.4
1897	622,350	8,477	44,699	1,762	14,765	33.0	29,934	67.0
1898	625,655	3,305	47,849	3,150	15,988	33.4	31,861	66.6
1899	650,610	24,955	51,437	3,588	16,925	32.9	34,512	67.1
1900	685,284	34,674	55,751	4,314	18,620	33.4	37,131	66.6
1901	716,621	31,337	60,984	5,233	20,008	32.8	40,976	67.2
1902	746,733	30,112	61,480	496	20,056	32.6	41,424	67.4
1903	786,132	39,399	64,925	3,445	21,321	32.8	43,604	67.2
1904	781,145	[1] 4,987	66,199	1,274	22,189	33.5	44,010	66.5
1905	804,787	23,642	67,976	1,777	22,220	32.7	45,756	67.3
1906	853,290	48,503	72,062	4,086	23,455	32.5	48,607	67.5

[1] Decrease.



ANNUAL NUMBER OF DIVORCES 1867-1906.

During the hunting season of 1911 there were 101 deaths recorded as against 113 for 1910, 87 in 1909, 57 in 1908, 82 in 1907 and 74 in 1906. The greatest number of deaths occurred in the State of Michigan where 16 persons were killed, followed by Illinois with 14 and Wisconsin with 13.

Foreign-Born White Population of the U. S. by Country of Birth.

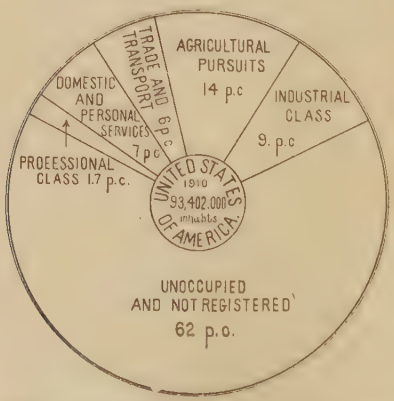
COUNTRY.	1910	1900	Increase.
Total foreign-born white	13,342,500	10,213,817	3,128,683
Austria-Hungary	1,658,700	636,968	1,021,732
Austria	1,190,200	491,259	698,941
Hungary	468,500	145,709	322,791
Germany	2,499,200	2,813,413	−314,213
Great Britain	1,221,400	1,166,863	54,537
England	875,400	839,830	35,570
Scotland	263,400	233,473	29,927
Wales	82,600	93,560	−10,960
Ireland	1,351,400	1,615,232	−263,832
Italy	1,341,800	483,963	857,837
Russia and Finland	1,706,900	640,710	1,066,190
Russia	1,577,300	578,072	999,228
Finland	129,600	62,638	66,962
Norway, Sweden, and Denmark	1,250,500	1,062,124	188,376
Norway	403,500	336,379	67,121
Sweden	665,500	571,986	93,514
Denmark	181,500	153,759	27,741
Other Europe	749,300	450,036	299,264
France	117,100	104,031	13,069
Greece	101,100	8,513	92,587
Holland	120,000	104,922	15,078
Switzerland	124,800	115,581	9,219
All other	286,300	116,989	169,311
Canada and Newfoundland	1,198,000	1,172,745	25,255
Mexico	218,800	101,908	116,892
All other countries	146,500	69,855	76,645

DIVORCES: NUMBER AND CAUSES, SPECIFYING THOSE GRANTED TO HUSBAND OR WIFE, BY QUINQUENNIAL PERIODS, 1887 TO 1906.

[Source: Reports of the Bureau of the Census, Department of Commerce and Labor.]

Cause.	1887–1891		1892–1896		1897–1901		1902–1906		Increase 1902–1906 as compared with 1887–1891	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
GRANTED TO HUSBAND.										
Adultery	17,139	31.2	19,956	30.4	24,269	28.1	29,526	27.0	12,387	72.3
Cruelty	4,047	7.4	6,068	9.2	9,385	10.9	13,678	12.5	9,631	238.0
Desertion	27,150	49.4	31,805	48.5	43,186	50.0	54,142	49.6	26,992	99.4
Drunkenness	592	1.1	765	1.2	986	1.1	1,093	1.0	501	84.6
Neglect to provide	.....	.....	2	(1)	1	(1)	3	(1)	3	(1)
Combinations of preceding causes, etc	2,654	4.8	3,190	4.9	3,681	4.3	4,805	4.4	2,151	81.0
All other causes[2]	3,398	6.2	3,836	5.8	4,798	5.6	5,994	5.5	2,596	76.4
Total	54,980	100.0	65,622	100.0	86,306	100.0	109,241	100.0	54,261	98.7
GRANTED TO WIFE.										
Adultery	10,880	10.6	13,714	10.6	16,915	9.7	21,360	9.6	10,480	96.3
Cruelty	25,200	24.6	34,509	26.7	48,797	28.0	64,541	28.9	39,341	156.1
Desertion	35,666	34.8	43,153	33.4	58,382	33.5	74,018	33.1	38,352	107.5
Drunkenness	5,397	5.3	6,913	5.3	8,828	5.1	11,942	5.3	6,545	121.3
Neglect to provide	4,605	4.5	6,857	5.3	10,423	6.0	12,779	5.7	8,174	177.5
Combinations of preceding causes, etc	13,770	13.5	15,757	12.2	19,979	11.5	25,013	11.2	11,243	81.6
All other causes[2]	6,826	6.7	8,414	6.5	11,090	6.4	13,748	6.2	6,922	101.4
Total	102,344	100.0	129,317	100.0	174,414	100.0	223,401	100.0	121,057	118.3

[1] Less than one-tenth of 1 per cent. [2] Includes causes unknown.



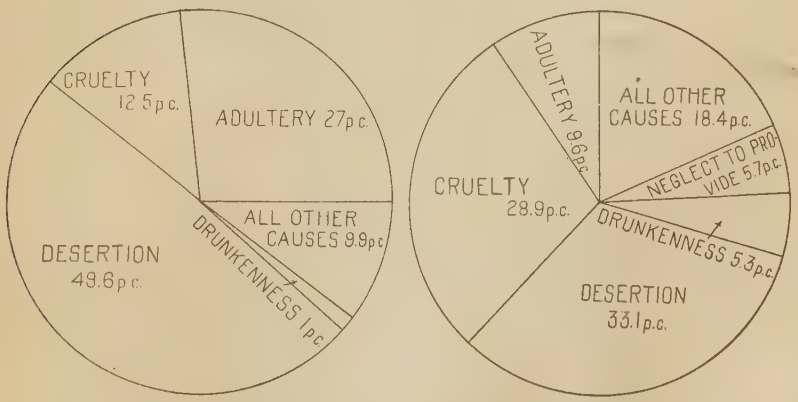
APPROXIMATE DISTRIBUTION OF PURSUITS.

DIVORCES: TOTAL NUMBER GRANTED, SPECIFYING THOSE GRANTED TO HUSBAND OR WIFE, BY NUMBER OF YEARS MARRIED, 1887 TO 1906.[1]

[Source: Reports of the Bureau of the Census, Department of Commerce and Labor.]

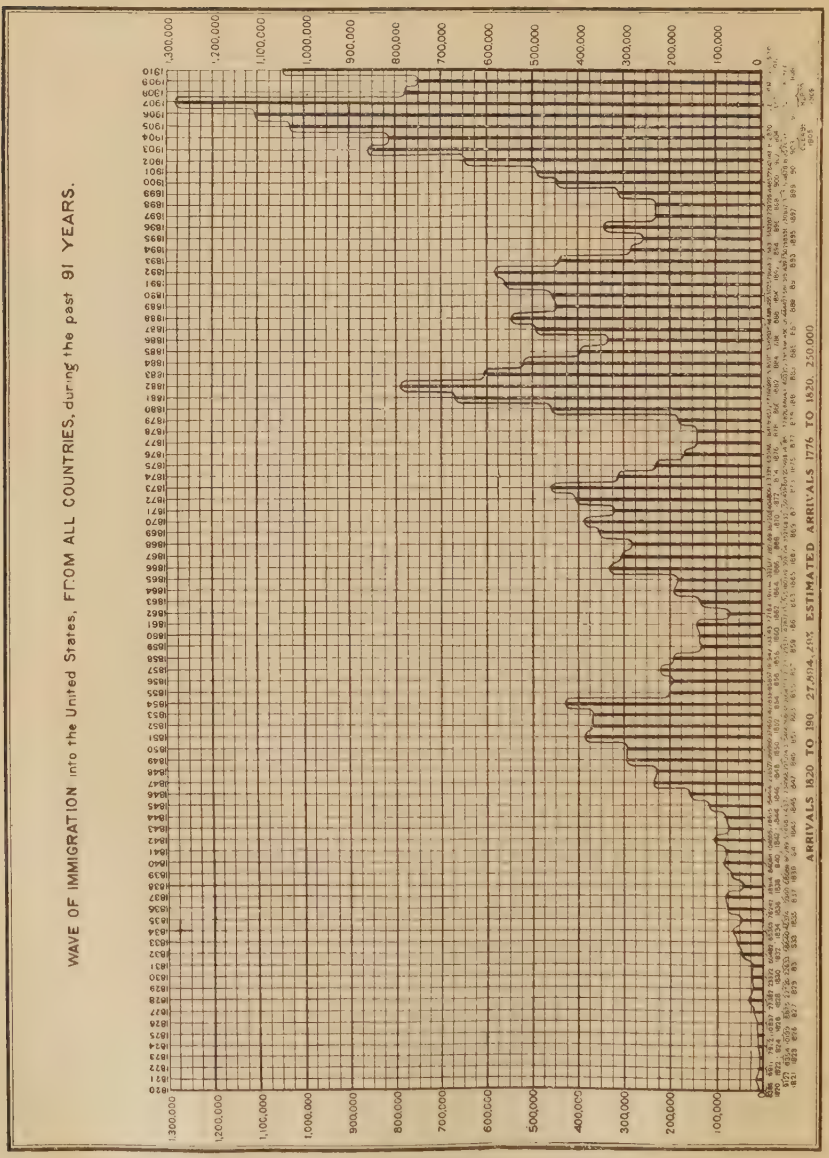
Number of years married.	Granted to husband.		Granted to wife.		Total.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
Less than 1 year	6,684	2.2	12,192	2.0	18,876	2.1
1 year	9,074	3.1	18,689	3.1	27,763	3.1
2 years	19,571	6.6	41,910	6.9	61,481	6.8
3 years	24,033	8.1	49,019	8.1	73,052	8.1
4 years	24,438	8.2	49,475	8.2	73,913	8.2
5 years	22,942	7.7	45,828	7.6	68,770	7.6
6 years	31,142	7.1	41,524	6.9	62,666	7.0
7 years	18,947	6.4	37,470	6.2	56,417	6.3
8 years	17,059	5.7	33,595	5.6	50,654	5.6
9 years	14,659	4.9	29,738	4.9	44.397	4.9
10 years	13,631	4.6	27,099	4.5	40,730	4.5
11 years	12,081	4.1	24,288	4.0	36,369	4.0
12 years	10,521	3.5	21,450	3.6	31,971	3.6
13 years	9,230	3.1	19,030	3.2	28,260	3.1
14 years	8,210	2.8	16,867	2.8	25,077	2.8
15 years	7,376	2.5	15,603	2.6	22,979	2.6
16 years	6,393	2.1	13,632	2.3	20,025	2.2
17 years	5,742	1.9	12,159	2.0	17,901	2.0
18 years	5,125	1.7	10,893	1.8	16,018	1.8
19 years	4,446	1.5	9,807	1.6	14,253	1.6
20 years	4,351	1.5	9,513	1.6	13,864	1.5
21 years	3,805	1.3	8,336	1.4	12,141	1.3
22 years	3,318	1.1	7,171	1.2	10,489	1.2
23 years	2,913	1.0	6,575	1.1	9,488	1.1
24 years	2,644	.9	5,952	1.0	8,596	1.0
25 years and over	19,120	6.4	35,314	5.9	54,434	6.0
Total	297,455	100.0	603,129	100.0	900,584	100.0

[1] Calendar years.



GRANTED TO HUSBAND. GRANTED TO WIFE.

CAUSES FOR DIVORCES 1902-1906.


WAVE OF IMMIGRATION into the United States, FROM ALL COUNTRIES, during the past 91 YEARS.
ARRIVALS 1820 TO 1910 27,804,295 ESTIMATED ARRIVALS 1776 TO 1820, 250,000

IMMIGRANT ALIENS ADMITTED, YEARS ENDED JUNE 30, 1902 TO 1911: BY RACE OR PEOPLE.

[Source: Reports of the Commissioner General of Immigration, Department of Commerce and Labor.]

Race or people.	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
African (black)	832	2,174	2,386	3,598	3,786	5,235	4,626	4,307	4,966	6,721
Armenian	1,151	1,759	1,745	1,878	1,895	2,644	3,299	3,108	5,508	3,092
Bohemian, Moravian	5,590	9,591	11,911	11,757	12,958	13,554	10,164	6,850	8,462	9,223
Bulgarian, Servian, Montenegrin	1,291	6,479	4,577	5,823	11,548	27,174	18,246	6,214	15,130	10,222
Chinese	1,631	2,192	4,327	1,971	1,485	770	1,263	1,841	1,770	1,307
Croatian, Slovenian	30,233	32,907	21,242	35,104	44,272	47,826	20,472	20,181	39,562	18,982
Cuban	2,423	2,944	4,811	7,259	5,591	5,475	3,323	3,380	3,331	3,914
Dalmatian, Bosnian, Herzegovinian	1,004	1,736	2,036	2,639	4,568	7,393	3,747	1,888	4,911	4,400
Dutch, Flemish	4,117	6,496	7,832	8,498	9,735	12,467	9,526	8,114	13,012	13,862
East Indian	84	83	258	145	271	1,072	1,710	337	1,782	517
English	14,942	28,451	41,479	50,865	45,079	51,126	49,056	39,021	53,498	57,258
Filipino	120	133	29	5						
Finnish	13,868	18,864	10,157	17,012	14,136	14,860	6,746	11,687	15,736	9,779
French	4,126	7,166	11,557	11,347	10,379	9,392	12,881	19,423	21,107	18,132
German	51,682	71,782	74,790	82,360	86,813	92,936	73,038	58,534	71,380	66,471
Greek	8,115	14,376	12,625	12,144	23,127	46,283	28,808	20,262	39,135	37,021
Hebrew	57,688	76,203	106,236	129,910	153,748	149,182	103,387	57,551	84,260	91,223
Irish	29,001	35,366	37,076	54,266	40,959	38,706	36,427	31,185	38,382	40,246
Italian (north)	27,620	37,429	36,699	39,930	46,286	51,564	24,700	25,150	30,780	30,312
Italian (south)	152,915	196,117	159,329	186,390	240,528	242,497	110,547	165,248	192,673	159,638
Japanese	14,455	20,041	14,382	11,021	14,243	30,824	16,418	3,275	2,798	4,575
Korean	28	564	1,907	4,929	127	39	26	11	19	8
Lithuanian	11,629	14,432	12,780	18,604	14,257	25,884	13,720	15,254	22,714	17,027
Magyar	23,610	27,124	23,883	46,030	44,261	60,071	24,378	28,704	27,302	19,996
Mexican	715	486	447	227	141	91	5,682	15,591	17,760	18,784
Pacific Islander	40	52	12	17	13	3	2	7	61	12
Polish	69,620	82,343	67,757	102,437	95,835	138,033	68,105	77,565	128,348	71,446
Portuguese	5,309	8,433	6,338	4,855	8,729	9,648	6,809	4,606	7,657	7,469
Roumanian	2,033	4,740	4,364	7,818	11,425	19,200	9,629	8,041	14,199	5,311
Russian	1,551	3,608	3,961	3,746	5,814	16,807	17,111	10,038	17,294	18,721
Ruthenian (Russniak)	7,533	9,843	9,592	14,473	16,257	24,081	12,361	15,808	27,907	17,724
Scandinavian	55,780	79,347	61,029	62,284	58,141	53,425	32,789	34,996	52,037	45,859
Scotch	2,432	6,219	11,483	16,144	16,463	20,516	17,014	16,446	24,612	25,625
Slovak	36,934	34,427	27,940	52,368	38,221	42,041	16,170	22,586	32,416	21,415
Spanish	1,954	3,297	4,662	5,590	5,332	9,495	6,636	4,939	5,837	8,068
Spanish-American	496	978	1,666	1,658	1,585	1,060	1,063	890	900	1,153
Syrian	4,982	5,551	3,653	4,822	5,824	5,880	5,520	3,668	6,317	5,444
Turkish	165	449	1,482	2,145	2,033	1,902	2,327	820	1,283	918
Welsh	760	1,278	1,820	2,531	2,367	2,754	2,504	1,699	2,244	2,248
West Indian (except Cuban)	137	1,497	1,942	1,548	1,476	1,381	1,110	1,024	1,150	1,141
All other peoples	147	89	668	351	1,027	2,058	1,530	1,537	3,330	3,323
Total	648,743	857,046	812,870	1,026,499	1,100,735	1,285,349	782,870	751,786	1,041,570	878,587

SUMMARY OF BOILER EXPLOSIONS.

A summary of the number of persons killed or injured, per explosions, for successive ten-year periods, shows that the boiler explosions of this country have been becoming less and less serious. In 1871 there were 89 explosions recorded, resulting in the death of 383 persons and injuries to 225, or 4.3 persons killed and 2.53 injured per explosion. In 1881 with 159 explosions, there were 251 persons killed and 313 injured, or 1.57 killed and 1.96 injured per explosion. In 1891, 257 explosions resulted in the death of 263 persons and injuries to 371, or 1.02 killed and 1.44 injured per explosion. In 1901, 423 explosions resulted in 312 deaths and injuries to 646, or 0.73 persons killed and 1.52 injured per explosion. In 1911, there were 499 explosions resulting in the death of 222 persons and injuries to 416, or 0.47 persons killed and 0.83 injured per explosion. This decrease is most probably due to the improvement that has taken place in the design, construction, and operation of steam boilers, and not to the increased use of sectional boilers, for experience has indicated that the bursting or rupture of such boilers is frequently attended with serious consequences in the way of killing or injuring the attendants.

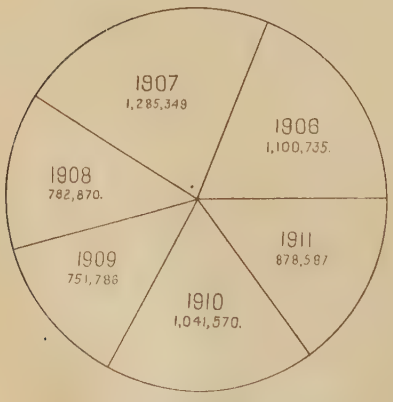
Courtesy of "*The Locomotive*," Jan. 1909.

TOTAL NUMBER OF IMMIGRANTS IN SPECIFIED YEARS, 1891 TO 1911: By Sex and Age; also Immigrants Debarred and Returned within One Year after Arrival, and Illiterates over 14 and 16 Years of Age.

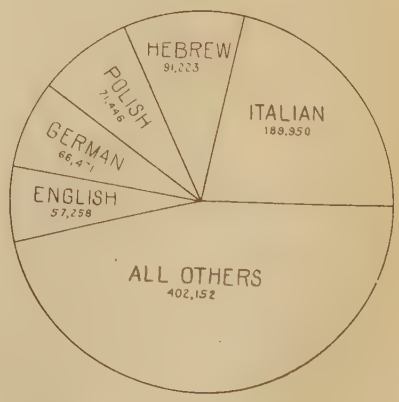
[Sources: Records of Bureau of Statistics prior to 1896; for subsequent years, reports of the Commissioner General of Immigration, Department of Commerce and Labor.]

Year ended June 30—	Total immigrants.	Sex.		Ages.			Debarred from landing.	Returned within 1 year after landing.	Returned within 3 years after landing.	Able to read, but not write. [1]	Unable to read or write. [1]
		Male.	Female.	Under 14 years.	14 to 45 years.	45 years and over.					
1891...	560,319	354,059	206,260	[2] 95,879	[3] 405,843	[4] 58,597	.....	.....	.....	.....	.....
1892...	623,084	385,781	237,303	[2] 89,167	[3] 491,839	[4] 42,078	2,164	637	.....	.....	.....
1893...	502,917	315,845	187,072	[2] 57,392	[3] 419,701	[4] 25,824	1,053	577	.....	59,582	61,038
1894...	314,467	186,247	128,220	[2] 41,755	[3] 258,162	[4] 14,550	2,389	417	.....	16,784	41,614
1895...	279,948	159,924	120,024	[2] 33,289	[3] 233,543	[4] 13,116	2,394	189	.....	2,612	42,302
1896...	343,267	212,466	130,801	[2] 52,741	[3] 254,519	[4] 36,007	2,799	238	.....	5,066	78,130
1897...	230,832	135,107	95,725	[2] 38,627	[3] 165,181	[4] 27,024	1,617	263	.....	1,572	43,008
1898...	229,299	135,775	93,524	[2] 38,267	[3] 164,905	[4] 26,127	3,030	199	.....	1,416	43,057
1899...	311,715	195,277	116,438	43,983	248,187	19,545	3,798	263	.....	1,022	60,446
1900...	448,572	304,148	144,424	54,624	370,382	23,566	4,246	356	.....	2,097	93,576
1901...	487,918	331,055	156,863	62,562	396,516	28,840	3,516	363	.....	3,058	117,587
1902...	648,743	466,369	182,374	74,063	539,254	35,426	4,974	465	.....	2,917	162,188
1903...	857,046	613,146	243,900	102,431	714,053	40,562	8,769	547	.....	3,341	185,667
1904...	812,870	549,100	263,770	109,150	657,155	46,565	7,994	300	479	3,953	168,903
1905...	1,026,499	724,914	301,585	114,668	855,419	56,412	11,879	98	747	8,209	230,882
1906...	1,100,735	764,463	336,272	136,273	913,955	50,507	12,371	61	615	4,755	265,068
1907...	1,285,349	929,976	355,373	138,344	1,100,771	46,234	13,064	70	925	5,829	337,573
1908...	782,870	506,912	275,958	112,148	630,671	40,051	10,902	114	1,955	2,310	172,293
1909...	751,786	519,969	231,817	88,393	624,876	38,517	10,411	58	2,066	2,431	191,049
1910...	1,041,570	736,038	305,532	120,509	868,310	52,751	24,270	23	2,672	4,571	253,569
1911...	878,587	570,057	308,530	117,837	714,709	46,041	22,349	9	2,779	2,930	182,273

[1] For the years prior to 1895 the figures are for persons over 16 years; for 1895 to 1910 for persons 14 years of age and over.
[2] Under 15 years. [3] 15 to 40 years. [4] 40 years and over.



1906-1911



1911

IMMIGRANT ALIENS ADMITTED.

Net Increase or Decrease of Population by Arrival and Departure of Aliens, Fiscal Year Ended June 30, 1910, by Races of Peoples.

Race or people.	Admitted.			Departed.			Increase (+) or decrease (−).
	Immigrant aliens.	Nonimmigrant aliens.	Total.	Emigrant aliens.	Nonemigrant aliens.	Total.	
African (black)	4,966	2,029	6,995	926	1,878	2,804	+ 4,191
Armenian	5,508	140	5,648	521	241	762	+ 4,886
Bohemian and Moravian (Czech)	8,462	604	9,066	943	520	1,463	+ 7,603
Bulgarian, Servian, and Montenegrin	15,130	1,244	16,374	2,720	1,385	4,105	+ 12,269
Chinese	1,770	4,746	6,516	2,383	5,267	7,650	− 1,134
Croatian and Slavonian	39,562	2,513	42,075	7,133	2,441	9,574	+ 32,501
Cuban	3,331	4,116	7,447	1,556	5,813	7,369	+ 78
Dalmatian, Bosnian, and Herzegovinian	4,911	251	5,162	432	168	600	+ 4,562
Dutch and Flemish	13,012	2,367	15,379	1,192	2,755	3,947	+ 11,432
East Indian	1,782	86	1,868	80	98	178	+ 1,690
English	53,498	22,572	76,070	6,508	33,582	40,090	+ 35,980
Finnish	15,736	1,492	17,228	1,276	2,607	3,883	+ 13,345
French	21,107	5,349	26,456	4,029	5,821	9,850	+ 16,606
German	71,380	14,650	86,030	13,303	13,145	26,448	+ 59,582
Greek	39,135	2,037	41,172	8,814	1,810	10,624	+ 30,548
Hebrew	84,260	3,503	87,763	5,689	3,682	9,371	+ 78,392
Irish	38,382	8,807	47,189	2,472	11,443	13,915	+ 33,274
Italian (north)	30,780	7,412	38,192	13,431	9,160	22,591	+ 15,601
Italian (south)	192,673	22,772	215,445	41,772	21,782	63,554	+151,891
Japanese	2,798	1,348	4,146	4,377	3,133	7,510	− 3,364
Korean	19	1	20	137	16	153	− 133
Lithuanian	22,714	628	23,342	1,812	603	2,415	+ 20,927
Magyar	27,302	2,766	30,068	10,533	4,610	15,143	+ 14,925
Mexican	17,760	3,237	20,997	210	973	1,183	+ 19,814
Pacific Islander	61	6	67	1	8	9	+ 58
Polish	128,348	6,055	134,403	16,884	5,049	21,933	+112,470
Portuguese	7,657	942	8,599	906	2,368	3,274	+ 5,325
Roumanian	14,199	755	14,954	1,834	813	2,647	+ 12,307
Russian	17,294	1,336	18,630	5,682	2,213	7,895	+ 10,735
Ruthenian (Russniak)	27,907	2,616	30,523	1,719	1,601	3,320	+ 27,203
Scandinavian (Norwegians, Danes, and Swedes)	52,037	11,569	63,606	5,032	13,877	18,909	+ 44,697
Scotch	24,612	6,315	30,927	1,992	7,883	9,875	+ 21,052
Slovak	32,416	3,074	35,490	9,259	1,912	11,171	+ 24,319
Spanish	5,837	4,555	10,392	2,323	3,676	5,999	+ 4,393
Spanish-American	900	1,563	2,463	387	1,631	2,018	+ 445
Syrian	6,317	754	7,071	1,077	816	1,893	+ 5,178
Turkish	1,283	139	1,422	1,058	506	1,564	− 142
Welsh	2,244	744	2,988	195	718	913	+ 2,075
West Indian (except Cuban)	1,150	963	2,113	388	1,304	1,692	+ 421
Other peoples	3,330	411	3,741	806	674	1,480	+ 2,261
Not specified	.....	.....	.....	20,644	.....	20,644	− 20,644
Total	1,041,570	156,467	1,198,037	202,436	177,982	380,418	+817,619
Admitted in and departed from Philippine Islands	2,308	7,223	9,531	1,010	8,785	9,795	− 264

Arrivals of Passengers at the Ports of the United States.

The total number of passengers that arrived at the various ports of the United States during the year 1900 was 594,478, of which number 120,477 were United States citizens returning from foreign countries; 25,429 were non-immigrant aliens; and 448,572 were immigrants. In 1905 the total number of passengers arriving at the ports of the United States was 1,234,615, and of this number 167,227 were United States citizens returning to the States; 40,889 were non-immigrant aliens; and 1,026,499 immigrants. For the year 1911 the total number of passengers arriving at the ports of the United States was 1,299,428, of which number 269,128 were United States citizens returning home; 151,713 were non-immigrant aliens; and 878,587 were immigrants.

During the year 1910 there were 2,838 fatalities in coal mines as against 1,465 in 1900; during the former year there were 403 persons lost at sea as against 418 in 1900; in 1911, there were 9,857 deaths as a result of railway accidents, as against 7,865 in 1900.

Sex, Age, Literacy, Financial Condition, etc., of Immigrant

Race or people.	Number admitted.	Sex.		Age.			Literacy, 14 years and over.			
		Male.	Female.	Under 14 years.	14 to 44 years.	45 years and over.	Can read but can not write.		Can neither read nor write.	
							Male.	Female.	Male.	Female.
African (black)	4,966	2,961	2,005	449	4,315	202	6	15	637	180
Armenian	5,508	4,686	822	389	4,957	162	2	.....	1,008	183
Bohemian and Moravian (Czech)	8,462	4,874	3,588	1,503	6,493	466	2	3	38	38
Bulgarian, Servian, and Montenegrin	15,130	14,253	877	388	14,250	492	11	.....	5,817	327
Chinese	1,770	1,598	172	221	1,397	152	11	3	142	87
Croatian and Slovenian	39,562	32,947	6,615	1,855	36,438	1,269	23	10	11,104	1,525
Cuban	3,331	2,342	989	550	2,516	265	2	.....	63	49
Dalmatian, Bosnian, and Herzegovinian	4,911	4,453	458	173	4,594	144	3	.....	1,696	168
Dutch and Flemish	13,012	8,742	4,270	2,630	9,611	771	5	1	188	88
East Indian	1,782	1,768	14	6	1,762	14	.....	.....	930	6
English	53,498	32,199	21,299	8,697	39,633	5,168	10	18	142	86
Finnish	15,736	10,724	5,012	1,235	14,182	319	5	4	30	34
French	21,107	11,715	9,392	4,918	14,114	2,075	18	18	1,177	567
German	71,380	42,191	29,189	12,165	54,142	5,073	68	59	1,910	1,472
Greek	39,135	36,580	2,555	1,041	37,589	505	13	.....	7,891	1,238
Hebrew	84,260	46,206	38,054	21,869	57,191	5,200	193	143	7,593	10,370
Irish	38,382	21,075	17,307	2,837	33,916	1,629	18	10	315	173
Italian (north)	30,780	23,754	7,026	2,722	27,014	1,044	16	1	1,611	417
Italian (south)	192,673	151,249	41,424	20,065	160,859	11,749	118	68	70,563	18,890
Japanese	2,798	915	1,883	121	2,609	68	.....	.....	42	689
Korean	19	14	5	2	16	1	.....	.....	.....	1
Lithuanian	22,714	15,360	7,354	1,813	20,381	520	605	471	6,619	3,827
Magyar	27,302	18,382	8,920	3,650	22,129	1,523	3	3	1,861	938
Mexican	17,760	11,617	6,143	4,078	11,951	1,731	18	15	5,103	2,892
Pacific Islander	61	45	16	.....	53	8	.....	.....	1	.....
Polish	128,348	91,275	37,073	9,798	115,112	3,438	1,237	1,059	29,598	11,900
Portuguese	7,657	4,887	2,770	1,526	5,691	440	2	1	2,814	1,348
Roumanian	14,199	12,602	1,597	389	12,778	1,032	6	.....	4,405	629
Russian	17,294	14,918	2,376	1,102	15,849	343	40	14	5,132	1,038
Ruthenian (Russniak)	27,907	21,198	6,709	1,063	25,933	911	56	29	10,660	2,878
Scandinavian (Norwegians, Danes, and Swedes)	52,037	35,019	17,018	4,452	45,588	1,997	5	5	28	25
Scotch	24,612	15,546	9,066	3,897	18,805	1,910	5	3	55	30
Slovak	32,416	23,642	8,774	2,787	28,537	1,092	66	25	4,691	1,611
Spanish	5,837	4,890	947	419	5,058	360	9	3	617	103
Spanish-American	900	645	255	123	687	90	1	.....	20	14
Syrian	6,317	4,148	2,169	946	5,111	260	3	6	1,289	1,229
Turkish	1,283	1,237	46	21	1,245	17	.....	.....	788	26
Welsh	2,244	1,504	740	359	1,714	171	.....	1	7	6
West Indian (except Cuban)	1,150	634	516	206	838	106	.....	.....	18	14
Other peoples	3,330	3,243	87	44	3,252	34	3	.....	1,836	34
Total	1,041,570	736,038	305,532	120,509	868,310	52,751	2,583	1,988	188,439	65,130
Admitted in Philippine Islands	2,308	1,984	324	440	1,768	100	.....	.....	167	24

Illiteracy in the United States.

The statement shows that in 1910 there were 71,580,270 persons 10 years of age or over in the United States, of whom 5,517,608 were unable to read or write, constituting 7.7 per cent. of the population.

The native whites, who constituted nearly 75.0 per cent. of the entire population, had the smallest number of illiterates, 1,535,530, or 3.0 per cent.

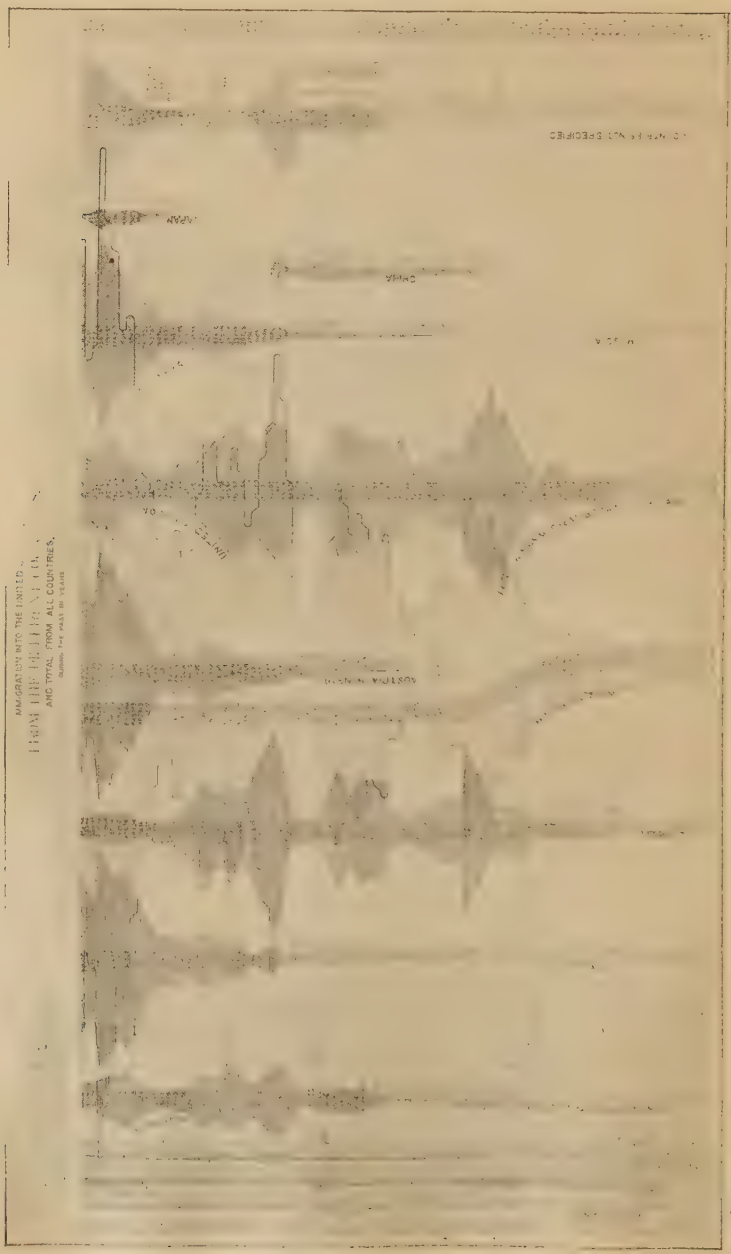
The foreign born whites had 1,650,519 illiterates, or 12.8 per cent. of their number.

The colored had 2,331,559 illiterates, or 30.5 per cent.

Aliens Admitted, Fiscal Year ended June 30, 1910, by Races or Peoples.

Money.			By whom passage was paid.			Going to join—		
Aliens bringing—		Total amount of money shown.	Self.	Relative.	Other than self or relative.	Relative.	Friend.	Neither relative nor friend.
$50 or over.	Less than $50.							
667	3,239	$112,099	3,831	994	141	3,371	615	980
479	4,033	143,120	4,678	811	19	4,552	880	76
1,075	5,026	287,071	5,463	2,948	51	7,181	1,091	190
779	13,527	390,864	14,177	907	46	7,395	7,129	606
622	1,040	70,242	886	854	30	862	281	627
1,503	34,455	871,332	35,926	3,501	135	28,576	10,303	683
599	1,259	78,371	2,106	1,199	26	2,444	367	520
279	3,962	111,285	4,507	394	10	3,553	1,175	183
2,749	5,058	582,471	7,994	4,795	223	9,310	2,847	855
324	1,412	63,152	1,623	137	22	178	451	1,153
18,377	17,784	2,966,225	35,004	17,097	1,397	36,733	9,307	7,458
1,487	12,205	441,467	10,537	4,671	528	9,701	5,589	446
5,295	5,657	958,165	11,917	8,670	520	15,504	2,438	3,165
15,706	30,791	3,300,315	47,878	22,567	935	57,778	9,754	3,848
2,547	34,047	961,087	37,019	2,078	38	26,974	11,637	524
5,367	36,501	1,555,585	39,698	44,174	388	79,660	3,024	1,576
5,812	24,832	1,467,480	23,541	14,300	541	33,049	3,309	2,024
4,031	21,115	875,644	25,774	4,727	279	24,974	4,764	1,042
12,008	146,608	3,616,088	147,763	44,092	818	182,269	8,706	1,698
1,427	1,070	144,369	497	2,265	36	2,271	159	368
12	4	940	14	4	1	6	7	6
805	16,958	391,798	14,004	8,538	172	21,104	1,457	153
2,177	19,193	591,476	19,905	7,333	64	23,597	2,809	896
759	7,450	178,951	9,438	8,129	193	8,442	1,218	8,100
40	1	2,545	.....	1	60	1	40	20
3,431	106,082	2,223,095	98,745	29,127	476	118,472	8,390	1,486
539	4,512	128,284	4,551	2,228	878	5,252	1,451	954
739	12,335	352,696	12,524	1,641	34	10,142	3,211	846
936	13,363	391,848	13,605	2,084	1,605	11,431	3,719	2,144
439	25,412	569,776	23,438	4,339	130	23,549	3,548	810
6,132	36,232	1,602,352	38,016	12,510	1,511	88,523	11,279	2,235
7,609	9,723	1,237,906	16,933	7,408	271	17,091	5,044	2,477
1,625	27,019	653,965	27,014	5,357	45	28,717	2,976	723
1,622	3,075	262,811	4,776	980	81	3,348	1,147	1,342
547	109	89,417	549	267	84	250	118	532
936	3,339	192,359	4,414	1,873	30	5,421	705	191
117	1,113	54,861	1,224	57	2	797	430	56
822	742	111,954	1,538	663	43	1,690	393	161
429	391	61,608	773	340	37	586	159	405
222	2,921	102,671	3,173	144	13	1,937	1,266	127
111,071	693,595	28,197,745	755,453	274,204	11,913	856,691	133,193	51,686
.....	.....	.....	1,465	726	117	888	261	1,159

There is a growing increase in the death rate due to accidents in the air. During the period 1896-1909, inclusive, there were only 8 deaths. There were 32 deaths in 1910, 99 in 1911 and 33 up to July 17, in 1912, the total being 172 deaths. France, which has been more active in aeronautics than any other nation, has lost 54 of her airmen, two of them women. The United States comes second with 33 victims, two of them women. Germany has lost 29, England 14, Russia 8, and Italy 7. Other nations which have lost one or more airmen are Spain, Belgium, Peru, Hungary and Holland.


IMMIGRATION INTO THE UNITED
FROM THE BEGINNING
AND TOTAL FROM ALL COUNTRIES,
DURING THE PAST 80 YEARS

INTENDED FUTURE PERMANENT RESIDENCE OF ALIENS ADMITTED AND LAST PERMANENT RESIDENCE OF ALIENS DEPARTED, FISCAL YEAR ENDED JUNE 30, 1910.

State or Territory.	Admitted.		Departed.	
	Immigrant aliens.	Nonimmigrant aliens.	Emigrant aliens.	Non-emigrant aliens.
Alabama	870	99	159	90
Alaska	356	160	101	92
Arizona	2,870	768	192	208
Arkansas	378	41	86	82
California	22,444	3,248	8,226	5,491
Colorado	5,114	536	1,376	764
Connecticut	27,540	2,257	3,283	1,661
Delaware	1,579	108	159	81
District of Columbia	1,380	276	348	237
Florida	6,207	2,795	1,967	3,156
Georgia	559	113	83	76
Hawaii	4,186	492	2,267	1,114
Idaho	1,508	93	134	118
Illinois	93,340	6,457	13,165	6,955
Indiana	10,556	602	1,357	494
Iowa	7,545	538	616	587
Kansas	2,984	216	493	279
Kentucky	736	73	151	61
Louisiana	1,952	332	602	534
Maine	5,328	226	292	290
Maryland	5,357	450	1,023	308
Massachusetts	82,666	7,742	11,172	8,706
Michigan	37,172	2,873	2,598	2,584
Minnesota	21,541	1,527	1,456	2,016
Mississippi	261	73	217	147
Missouri	12,746	826	2,451	947
Montana	5,101	389	603	734
Nebraska	5,244	307	458	377
Nevada	915	86	201	136
New Hampshire	6,561	269	571	194
New Jersey	56,462	4,951	8,468	3,435
New Mexico	853	113	133	109
New York	280,880	30,629	59,149	27,549
North Carolina	312	42	54	46
North Dakota	7,626	373	195	490
Ohio	50,746	3,112	7,286	2,927
Oklahoma	1,092	71	224	77
Oregon	4,224	310	571	514
Pennsylvania	174,877	12,417	27,040	9,800
Philippine Islands	22	4	4	5
Porto Rico	1,264	550	688	414
Rhode Island	12,078	1,076	1,207	1,230
South Carolina	191	17	36	30
South Dakota	3,389	212	126	277
Tennessee	574	83	94	53
Texas	18,741	2,068	920	246
Utah	3,578	218	534	253
Vermont	2,687	198	354	174
Virginia	1,521	135	362	158
Washington	15,769	1,566	1,581	1,762
West Virginia	9,132	650	1,260	410
Wisconsin	19,073	1,191	2,090	1,108
Wyoming	1,483	117	210	168
Outside the United States	.....	62,392	.....	88,228
Unknown [a]	.....	.....	34,043	.....
Total	1,041,570	156,467	202,436	177,982

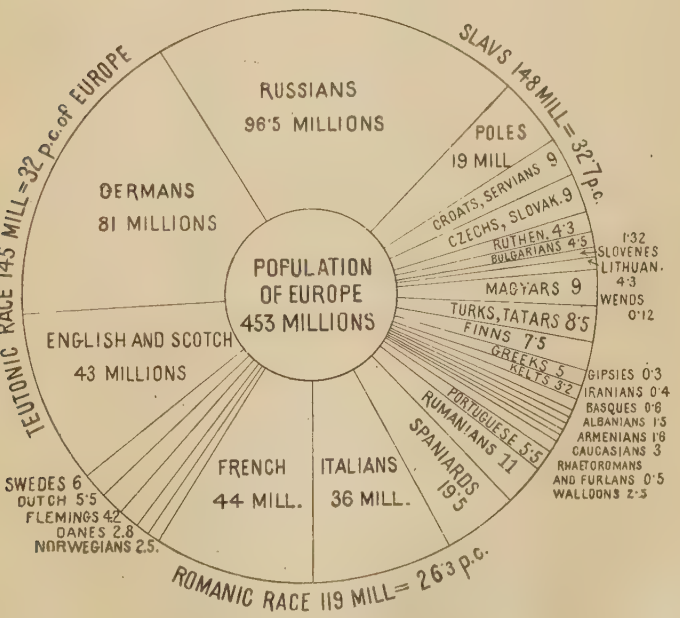
OCCUPATION OF ALIENS.

Occupation.	Admitted.		Departed.	
	Immigrant aliens.	Nonimmigrant aliens.	Emigrant aliens.	Nonemigrant aliens.
PROFESSIONAL.				
Actors	1,233	1,339	199	791
Architects	312	179	85	244
Clergy	823	804	285	983
Editors	154	181	23	195
Electricians	689	213	84	241
Engineers (professional)	1,921	1,911	467	2,183
Lawyers	230	520	47	685
Literary and scientific persons	282	294	65	209
Musicians	844	457	328	696
Officials (government)	264	551	163	711
Physicians	365	659	146	842
Sculptors and artists	398	280	471	527
Teachers	1,524	785	516	1,277
Other professional	1,295	1,163	401	1,164
Total professional	10,334	9,336	3,280	10,748
SKILLED.				
Bakers	3,469	562	526	549
Barbers and hairdressers	2,558	539	582	424
Blacksmiths	4,789	577	356	396
Bookbinders	425	50	33	32
Brewers	185	66	37	55
Butchers	2,797	460	360	419
Cabinetmakers	607	87	77	127
Carpenters and joiners	13,887	2,200	1,501	2,731
Clerks and accountants	11,297	4,027	1,523	4,887
Dressmakers	6,491	712	475	771
Engineers (locomotive, marine, and stationary)	1,695	669	298	605
Engravers	124	30	18	28
Furriers and fur workers	543	69	49	63
Gardeners	1,384	395	229	428
Hat and cap makers	500	61	40	45
Iron and steel workers	2,845	359	120	366
Jewelers	352	99	60	144
Locksmiths	2,346	172	51	54
Machinists	3,336	777	414	982
Mariners	4,869	2,039	640	1,447
Masons	6,257	1,116	573	989
Mechanics (not specified)	1,449	406	287	461
Metal workers (other than iron, steel, and tin)	808	114	46	60
Millers	684	93	36	41
Milliners	703	97	65	113
Miners	7,851	1,675	6,665	4,340
Painters and glaziers	3,460	536	343	612
Pattern makers	242	31	4	26
Photographers	308	97	57	97
Plasterers	654	129	38	190
Plumbers	745	154	46	170
Printers	951	176	112	199
Saddlers and harness makers	467	49	24	53
Seamstresses	4,546	277	326	192
Shipwrights	174	24	6	1
Shoemakers	8,785	946	752	643
Stokers	1,057	312	512	347
Stonecutters	1,491	301	209	322
Tailors	18,701	1,348	1,875	1,409
Tanners and curriers	486	52	31	28
Textile workers (not specified)	1,278	158	197	651
Tinners	720	93	49	85
Tobacco workers	2,265	1,454	802	2,419
Upholsterers	287	36	30	47
Watch and clock makers	567	64	54	61
Weavers and spinners	4,500	451	247	561
Wheelwrights	538	59	3	15
Woodworkers (not specified)	585	57	31	75
Other skilled	3,512	964	763	1,608
Total skilled	138,570	25,219	21,574	30,368

OCCUPATION OF ALIENS—Continued.

Occupation.	Admitted.		Departed.	
	Immigrant aliens.	Nonimmigrant aliens.	Emigrant aliens.	Nonemigrant aliens.
MISCELLANEOUS.				
Agents	922	1,566	154	938
Bankers	238	511	86	813
Draymen, hackmen, and teamsters	932	212	134	335
Farm laborers	288,745	22,159	3,082	7,337
Farmers	11,793	3,683	3,015	5,529
Fishermen	1,225	297	148	209
Hotel keepers	236	276	110	231
Laborers	214,300	24,726	89,393	42,279
Manufacturers	450	685	86	945
Merchants and dealers	10,746	10,349	4,582	12,545
Servants	96,658	13,152	8,318	17,630
Other miscellaneous	6,419	3,943	1,891	4,588
Total miscellaneous	632,664	81,559	110,999	93,379
No occupation (including women and children)	260,002	40,353	32,540	43,487
Unknown[a]	.....	.....	34,043	.....
Grand total	1,041,570	156,467	202,436	177,982

[a] Left United States via Canadian border. Figures reported by Canadian government.



THE RACES OF MANKIND.

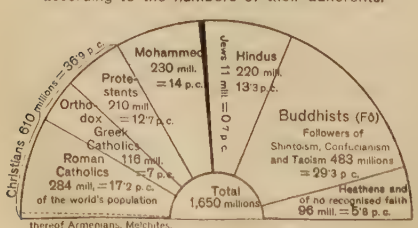
RELIGIONS OF THE UNITED STATES.

DENOMINATIONS	SUMMARY FOR 1911		
	MINISTERS	CHURCHES	COMMUNICANTS
Adventists (6 bodies)	1,170	2,499	95,764
Baptists (15 bodies)	41,627	56,439	5,634,565
Brethren (Dunkards, 4 bodies)	3,462	1,216	123,677
Brethren (Plymouth, 4 bodies)	.....	403	10,566
Brethren (River, 3 bodies)	220	102	4,847
Buddhists (2 bodies)	15	74	3,165
Catholic Apostolic (2 bodies)	83	24	4,927
Catholics (Eastern Orthodox, 7 bodies)	237	239	424,000
Catholics (Western, 3 bodies)	17,151	13,731	12,575,085
Christadelphians	.....	70	1,412
Christians	993	1,329	87,478
Christian Catholic (Dowie)	35	17	5,865
Christian Scientists	2,612	1,306	85,096
Christian Union	295	237	13,905
Church of God (Winebrennarian)	509	595	41,475
Church of the Living God (Colored, 3 bodies)	101	68	4,286
Church of the New Jerusalem (2 bodies)	131	146	9,390
Communistic Societies (2 bodies)	.....	22	2,272
Congregationalists	6,070	6,050	741,400
Disciples of Christ (2 bodies)	8,070	13,479	1,464,774
Evangelical (2 bodies)	1,492	2,634	183,574
Faith Associations (9 bodies)	241	146	9,572
Free Christian Zion Church	20	15	1,835
Friends (4 bodies)	1,413	1,167	122,796
Friends of the Temple	3	3	376
German Evangelical Protestant	59	66	34,704
German Evangelical Synod	1,036	1,308	253,890
Jewish Congregations	1,084	1,769	143,000
Latter-Day Saints (2 bodies)	2,483	1,350	400,650
Lutherans (23 bodies)	8,774	14,321	2,289,897
Scandinavia Evangelical (3 bodies)	608	844	68,500
Mennonites (12 bodies)	1,008	606	55,007
Methodists (17 bodies)	42,583	61,969	6,819,660
Moravians (2 bodies)	142	135	18,939
Non-sectarian Bible Faith Churches	50	204	6,396
Pentecostal (2 bodies)	865	500	21,921
Presbyterians (12 bodies)	13,396	16,711	1,944,181
Protestant Episcopal (2 bodies)	5,453	7,701	956,930
Reformed (4 bodies)	2,154	2,657	451,938
Salvationists (2 bodies)	3,112	872	26,724
Schwenkfeldians	6	8	850
Social Brethren	15	17	1,262
Society for Ethical Culture	7	6	2,450
Spiritualists	.....	1,500	200,000
Theosophical Society	.....	123	3,092
United Brethren (2 bodies)	2,207	4,362	311,834
Unitarians	533	492	70,542
Universalists	709	886	53,048
Independent Congregations	267	879	48,673
Grand total for 1911	172,431	221,197	35,836,190
Grand total for 1910	170,441	218,365	35,241,824

d Decrease. *c* Census of 1906.

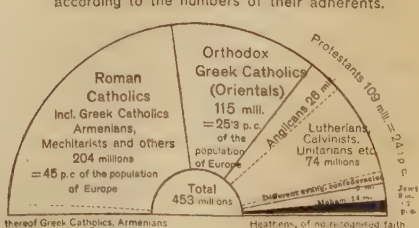
The Religions of Mankind

according to the numbers of their adherents.


Christians 610 millions = 35·9 p. c.
Mohammedans 230 mill. = 14 p. c.
Jews 11 mill. = 0·7 p. c.
Hindus 220 mill. 13·3 p. c.
Protestants 210 mill. = 12·7 p. c.
Orthodox Greek Catholics 116 mill. = 7 p. c.
Roman Catholics 284 mill. = 17·2 p. c. of the world's population
Buddhists (Fô) Followers of Shintoism, Confucianism and Taoism 483 millions = 29·3 p. c.
Heathens and of no recognised faith 96 mill. = 5·8 p. c.
Total 1,650 millions
thereof Armenians, Melchites, Copts and others 7,000,000

The Religions of Europe

according to the numbers of their adherents.


Roman Catholics Incl. Greek Catholics Armenians, Mechitarists and others 204 millions = 45 p. c of the population of Europe
Orthodox Greek Catholics (Orientals) 115 mill. = 25·3 p. c. of the population of Europe
Protestants 109 mill. = 24·1 p. c.
Anglicans 28 mill.
Lutherans, Calvinists, Unitarians etc. 74 millions
Total 453 millions
Jews 2 mill. = 0·5 p. c.
Mohammedans 14 mill.
thereof Greek Catholics, Armenians and others 6 millions
Heathens, of no recognised faith and others 2 mill. = 0·5 p. c.

ORDER OF DENOMINATIONS.

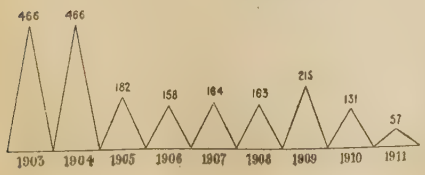
Denominations.	Rank in 1911.	Communicants.	Rank in 1890.	Communicants.
Roman Catholic	1	12,556,612	1	6,231,417
Methodist Episcopal	2	3,234,822	2	2,240,354
Regular Baptist (South)	3	2,304,724	4	1,280,066
Methodist Episcopal (South)	4	1,892,454	5	1,209,976
Regular Baptist (Colored)	5	1,799,222	3	1,348,989
Presbyterian (Northern)	6	1,340,310	7	788,244
Disciples of Christ	7	1,308,116	8	641,051
Regular Baptist (North)	8	1,211,426	6	800,450
Protestant Episcopal	9	947,320	9	532,054
Lutheran Synodical Conference	10	780,938	12	357,153
Congregationalist	11	741,400	10	512,771
African Methodist Episcopal	12	620,234	11	452,725
African Methodist Episcopal Zion	13	547,216	13	349,788
Lutheran General Council	14	467,495	14	324,846
Latter-Day Saints	15	350,000	21	144,352
Lutheran General Synod	16	309,702	20	164,640
Reformed (German)	17	297,829	15	204,018
United Brethren	18	291,461	16	202,474
Presbyterian (Southern)	19	287,174	18	179,721
German Evangelical Synod	20	253,890	17	187,432
Colored Methodist Episcopal	21	234,721	24	129,383
Spiritualists	22	200,000	39	45,030
Methodist Protestant	23	183,318	22	141,989
Greek Orthodox (Catholic)	24	175,000	138	100
United Norwegian Lutheran	25	170,088	26	119,972
United Presbyterian	26	136,850	27	94,402
Lutheran Synod of Ohio	27	131,923	33	69,505
Reformed (Dutch)	28	117,288	28	92,970
Evangelical Association	29	109,506	23	133,313
Primitive Baptist	30	102,311	25	121,347
Dunkard Brethren (Conservative)	31	100,000	35	61,101

ORDER OF DENOMINATIONAL FAMILIES.

Denominational Families.	Rank in 1911.	Communicants.	Rank in 1890.	Communicants.
Catholic (Roman, etc.)	1	12,575,085	1	6,257,871
Methodist	2	6,819,660	2	4,589,284
Baptist	3	5,634,565	3	3,717,969
Lutheran	4	2,289,897	5	1,231,072
Presbyterian	5	1,944,181	4	1,278,362
Episcopal	6	956,930	6	540,509
Reformed	7	451,938	7	309,458
Latter-Day Saints	8	400,650	9	166,125
United Brethren	9	311,834	8	225,281
Dunkard Brethren	10	123,677	13	73,795
Friends	11	122,796	11	107,208
Adventists	12	95,764	14	60,491

—Courtesy of the Christian Advocate.

FOURTH OF JULY FATALITIES.



Fourth of July fatalities in 1912 were reduced to 17 as a result of the movement to do away with the old custom of causing dangerous explosions for fun. In 1911 there had been 57 deaths. The number of persons injured in 1912 was 326 as against 1,546 in 1911 and 2,792 in 1910. The loss sustained by Fourth of July fires caused by gunpowder throughout the country exceeded half a million dollars.

PENSION ACT APPROVED MAY 11, 1912.

That any person who served ninety days or more in the military or naval service of the United States during the late Civil War, who has been honorably discharged therefrom, and who has reached the age of sixty-two or over, shall, upon making proof of such facts, according to such rules and regulations as the Secretary of the Interior may provide, be placed upon the pension roll and be entitled to receive a pension as follows: In case such person has reached the age of sixty-two years and served ninety days, thirteen dollars per month; six months, thirteen dollars and fifty cents per month; one year, fourteen dollars per month; one and a half years, fourteen dollars and fifty cents per month; two years, fifteen dollars per month; two and a half years, fifteen dollars and fifty cents per month; three years or over, sixteen dollars per month. In case such person has reached the age of sixty-six years and served ninety days, fifteen dollars per month; six months, fifteen dollars and fifty cents per month; one year, sixteen dollars per month; one and a half years, sixteen dollars and fifty cents per month; two years, seventeen dollars per month; two and a half years, eighteen dollars per month; three years or over, nineteen dollars per month. In case such person has reached the age of seventy years and served ninety days, eighteen dollars per month; six months, nineteen dollars per month; one year, twenty dollars per month; one and a half years, twenty-one dollars and fifty cents per month; two years, twenty-three dollars per month; two and a half years, twenty-four dollars per month; three years or over, twenty-five dollars per month. In case such person has reached the age of seventy-five years and served ninety days, twenty-one dollars per month; six months, twenty-two dollars and fifty cents per month; one year, twenty-four dollars per month; and a half years, twenty-seven dollars per month; two years or over, thirty dollars per month. That any person who served in the military or naval service of the United States during the Civil War and received an honorable discharge and who was wounded in battle or in line of duty and is now unfit for manual labor by reason thereof, or who from disease or other causes incurred in line of duty resulting in his disability is now unable to perform manual labor, shall be paid the maximum pension under this Act, to wit, thirty dollars per month, without regard to length of service or age.

That any person who has served sixty days or more in the military or naval service of the United States in the War with Mexico and has been honorably discharged therefrom, shall, upon making like proof of such service, be entitled to receive a pension of thirty dollars per month.

All of the aforesaid pensions shall commence from the date of filing of the applications in the Bureau of Pensions after the passage and approval of this Act: *Provided*, That pensioners who are sixty-two years of age or over, and who are now receiving pensions under existing laws, or whose claims are pending in the Bureau of Pensions, may, by application to the Commissioner of Pensions, in such form as he may prescribe, receive the benefits of this Act; and nothing herein contained shall prevent any pensioner or person entitled to a pension from prosecuting his claim and receiving a pension under any other general or special Act: *Provided*, That no person shall receive a pension under any other law at the same time or for the same period that he is receiving a pension under the provisions of this Act: *Provided further*, That no person who is now receiving or shall hereafter receive a greater pension, under any other general or special law, than he would be entitled to receive under the provisions herein shall be pensionable under this act.

SEC. 2. That rank in the service shall not be considered in applications filed hereunder.

SEC. 3. That no pension attorney, claim agent, or other person shall be entitled to receive any compensation for services rendered in presenting any claim to the Bureau of Pensions, or securing any pension, under this Act, except in applications for original pension by persons who have not heretofore received a pension.

SEC. 4. That the benefits of this Act shall include any person who served during the late Civil War, or in the War with Mexico, and who is now or may hereafter become entitled to pension under the Acts of June twenty-seventh, eighteen hundred and ninety, February fifteenth, eighteen hundred and ninety-five, and the joint resolutions of July first, nineteen hundred and two, and June twenty-eighth, nineteen hundred and six, or the Acts of January twenty-ninth, eighteen hundred and eighty-seven, March third, eighteen hundred and ninety-one, and February seventeenth, eighteen hundred and ninety-seven.

SEC. 5. That it shall be the duty of the Commissioner of Pensions, as each application for pension under this Act is adjudicated, to cause to be kept a record showing the name and length of service of each claimant, the monthly rate of payment granted to or received by him, and the county and state of his residence; and shall at the end of the fiscal year nineteen hundred and fourteen tabulate the record so obtained by States and counties, and shall furnish certified copies thereof upon demand and the payment of such fee therefor as is provided by law for certified copies of records in the executive departments.

PENSIONS.

On June 30, 1911, the pensioners on the roll of the United States Government were divided as follows: War of 1812, widows 279; Indian wars, survivors 1,387, widows 2,629; War with Mexico, survivors 1,639, widows 5,982; Civil War, by the Act of February 6, 1907, 356,830, by the general law, invalids 113,063, widows 67,509, minor children 385, mothers 1,877, fathers 278, brothers, sisters, sons and daughters 5,353, helpless children 508, by the Act of June 27, 1890, invalids 59,991, minor children 3,983, helpless children

375, by the Act of April 19, 1908, widows 228,198, army nurses 406; war with Spain, invalids 23,383, widows 1,217, minor children 326, mothers 3,032, fathers 522, brothers, sisters, sons and daughters 9, helpless children 1; and by regular establishment, invalids 13,757, widows 2,799, minor children 149, mothers 1,066, fathers 152, brothers, sisters, sons and daughters 8, helpless children 5. Thus the total number of pensioners at that time was 892,098; the number of soldiers and sailors on the roll being 570,050; the number of dependents and widows 321,642, and the number of army nurses 406.

The total amount available for pensions for the fiscal year ended June 30, 1911 was $157,507,359.74 and of this amount $157,325,160.35 was disbursed; thus leaving an unexpended balance of $182,199.39.

With the total number of pensioners 892,098, and the total annual value of the pensions $154,834,237.80, the average annual value of each pension for all classes amounts to $173.56; by general establishment each pension has an annual value of $173.63; by the General Law, Civil War $228.58; by the Act of June 27, 1890 $143.26; by the war with Spain $128.47; by the Act of Feb. 6, 1907 $173.47; for survivors of the Civil War $191.41; by the Act of April 19, 1908, $141.99.

Beginning with the year 1866 the number of pensioners for certain years were as follows:

1866, 126,722; 1870, 198,686; 1875, 234,821; 1880, 250,802; 1885, 345,125; 1890, 537,944; 1895, 970,524; 1900, 993,529; 1905, 998,441; 1910, 921,083; 1911, 892,098.

PENSIONS OF THE SEVERAL WARS AND OF THE PEACE ESTABLISHMENT.

The amounts that have been paid for pensions to soldiers, sailors, and marines, their widows, minor children, and dependent relatives on account of military and naval service in the several wars and in the regular service since the foundation of the Government to June 30, 1911, are as follows:

War of the Revolution (estimate)	$70,000,000.00
War of 1812 (service pension	45,853,024.19
Indian wars (service pension)	11,192,205.52
War with Mexico (service pension)	45,279,686.83
Civil War	3,985,719,836.93
War with Spain and insurrection in Philippine Isls.	34,142,976.37
Regular establishment	21,705,852.33
Unclassified	16,488,147.99
Total disbursements for pensions	$4,230,381,730.16

HISTORICAL.

There are now no pensioners on account of the Revolutionary War on the roll, the last pensioner of that war having died during the year 1911. The last survivor of the Revolution was Daniel F. Bakeman, who died at Freedom, Cattaraugas County, N. Y., on April 5, 1869, aged 100 years 6 months and 8 days.

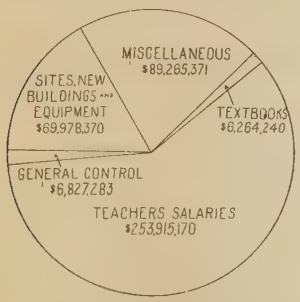
The last surviving pensioned soldier of the War of 1812 was Hiram Cronk, of Ava, N. Y., who died May 13, 1905, aged 105 years and 16 days.

POPULATION OF CANADA.

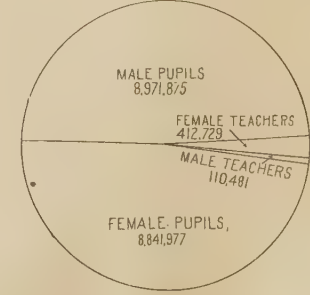
The population of Canada by first census of 1665 was 3,251; in 1763, 70,000; in 1871, 3,485,761; in 1881, 4,324,810; in 1891, 4,833,239; in 1901, 5,371,315. Canada began the 20th century with the same population as the United States began the 19th. Unrevised returns of the census in 1911 give the population at 7,081,869, an increase of 1,710,554, or 32 per cent. in ten years.

The population of Canada by provinces, as shown by the census of 1901 and 1911, is as follows:

	1911	1901
Alberta	372,919	73,022
British Columbia	362,768	178,657
Manitoba	454,691	255,211
New Brunswick	351,815	331,120
Nova Scotia	461,847	459,574
Ontario	2,519,902	2,182,947
Prince Edward Island	93,722	103,259
Quebec	2,000,697	1,648,898
Saskatchewan	453,508	91,279
Northwest Territories	10,000	20,129
Yukon	.....	27,129
	7,081,869	5,371,315



EXPENDITURES FOR 1910.



PUPILS ENROLLED AND TEACHERS EMPLOYED.

COMMON SCHOOLS OF UNITED STATES, 1910.

EDUCATION.

School Attendance in the United States.

The statistics relative to school attendance in the United States has just become available. The total number of persons of school age, that is to say, from 6 to 20 years, inclusive, in continental United States in 1910 was 27,750,599, of whom 17,300,202, or 62.3 per cent. attended school.

Persons from 6 to 9 years of age numbered 7,725,234, of whom 5,678,320, or 73.5 per cent. attended school, while those from 10 to 14 years of age numbered 9,107,140, of whom 8,028,660, or 88.2 per cent. attended school.

Of the whole number of persons from 15 to 17 years of age, namely, 5,372,177, those attending school numbered 2,748,387, or 51.2 per cent., while of the 5,546,048 persons from 18 to 20 years of age, there were 844,835, or 15.2 per cent. who attended school.

For the combined group, 6 to 14 years, inclusive—the most common years of school attendance—there was a total of 16,832,374 persons reported in 1910 and of this number 13,706,980, or 81.4 per cent., attended school.

It will be noted that the period of maximum school attendance is in the ages 10 to 14 years. For these years a comparison can be made with the census of 1900. In 1900, 79.8 per cent. of the children attended school, as compared with 88.2 per cent. in 1910. The following summary gives the percentage of children 10 to 14 years of age attending school in each of the years 1910 and 1900 by geographic divisions:

	1910	1900
United States	88.2	79.8
New England	94.1	90.0
Middle Atlantic	92.9	85.7
East North Central	93.8	88.1
West North Central	93.6	88.3
	1910	1900
South Atlantic	78.7	65.6
East South Central	79.0	65.8
West South Central	80.5	68.3
Mountain	90.2	85.2
Pacific	94.1	91.8

In the Northern and Western divisions over nine-tenths of the children in these ages are enrolled in schools. In the three Southern divisions, the proportion approximates eight-tenths. A comparison of the two years shows an advance in all sections, but it is most marked in the Southern states, reflecting the great progress of popular education in those states in recent years.

The age of compulsory school attendance where it exists differs under the laws for different states. It generally begins when a child reaches 8 years of age and ceases when he reaches 14 years of age. The percentage of children in the ages 8 to 13 years, both inclusive, who attend school is undoubtedly higher than for the children 6 to 14 years, given in the table. The latter group comprises some children who have not begun and some who have finished their schooling.

Public High Schools and Private High Schools and Academies.

In the school year 1911 there were 10,234 public high schools, and 1,979 private high schools. In the public high schools there were 20,152 male secondary teachers and 25,015 female secondary teachers; 433,053 male secondary students and 551,624 female secondary students.

In the private high schools there were 4,986 male teachers and 7,087 female teachers; there were 61,298 male secondary students and 69,351 female secondary students.

Public and Private Normal Schools in the United States.

In the school year 1911 there were 223 public normal schools having 1,254 male teachers and 2,385 female teachers. There were 15,358 male students and 60,284 female students. There were 65 private normal schools, having 202 male and 286 female teachers, and 2,622 male students and 5,831 female students.

Universites, Colleges and Technological Schools.

In the school year there were 581 institutions of this class, having 23,260 male professors and instructors and 5,025 female professors and instructors. In the preparatory schools there were 39,615 male and 20,552 female students. In the collegiate department there were 111,449 male students and 61,265 female students. The total receipts, exclusive of additions to endowment funds, was $80,902,571.

Undergraduate Students in Universities, Colleges and Schools of Technology.

Out of 581 institutions included under the above head, there were 145 colleges for men, having 37,144 undergraduate students. There were 97 colleges for women, having 18,985 undergraduate students. There were 339 coeducational institutions, having 74,305 male undergraduate students, and 42,280 female undergraduate students, making a total of 116,585.

Professional Schools.

In the school year 1911 the number of schools and of students was as follows:

193 schools of theology served 10,834 students; 116 law schools had 19,615 students enrolled; 122 medical colleges had 19,146 students enrolled; 55 dental colleges had 6,961 students; 77 schools of pharmacy had 6,131 students; 21 veterinary schools had 2,571 students.

Schools for the Blind, Deaf and Feeble-Minded.

In the school year 1911 there were 53 State schools for the blind in the United States, having 4,670 pupils. There were 57 State schools for the deaf, having 10,740 pupils. In addition there were 55 public day schools for the deaf, having 1,607 pupils, and 20 private schools, having 693 pupils. There were also 27 State institutions for the feeble-minded caring for 19,672 inmates, while 18 private institutions cared for 997 inmates.

REGISTRATION STATISTICS OF SPECIFIED UNIVERSITIES ON NOVEMBER 1, 1911.

[Data furnished by Rudolf Tombo, jr., alumni secretary Columbia University.]

University.	Total attendance[1] Nov. 1, 1911.	Attendance summer session, 1911.	Grand total.	Deduct summer session students who returned in fall.	Net total, Nov. 1, 1911.	Total, Nov. 1, 1910.	Total, Nov. 1, 1908.	Total, Nov. 1, 1903.
California	4,051	1,964	6,015	291	5,724	4,758	3,751	3,690
Chicago	2,666	3,248	5,914	524	5,390	5,883	5,114	4,146
Columbia	5,669	2,973	8,642	704	7,938	7,411	5,675	4,557
Cornell	4,889	1,152	6,041	432	5,609	5,169	4,700	3,438
Harvard (including Radcliffe)	4,724	787	5,511	85	5,426	5,329	5,342	6,013
Illinois	4,570	647	5,217	288	4,929	4,659	4,400	3,239
Indiana	1,350	1,068	2,418	264	2,154	2,132	2,113	1,143
Iowa	1,772	309	2,081	114	1,967	1,957	2,356	1,260
Johns Hopkins	740	335	1,075	18	1,057	784	698	694
Kansas	2,019	429	2,448	183	2,265	2,246	2,086	1,319
Michigan	4,783	1,194	5,977	525	5,452	5,339	5,188	3,926
Minnesota	4,307	476	4,783	235	[2] 4,548	4,972	4,607	3,550
Missouri	2,273	507	2,780	184	2,596	2,678	2,558	1,540
Nebraska	2,474	403	2,877	144	[3] 2,733	3,661	3,154	2,513
New York	3,688	490	4,178	123	4,055	3,947	3,951	2,177
Northwestern	3,387	94	3,481	43	3,438	3,543	3,113	2,740
Ohio State	3,085	792	3,877	310	3,567	3,181	2,700	1,710
Pennsylvania	4,718	682	5,400	180	5,220	5,187	4,555	2,644
Princeton	1,543	.....	1,543	.....	1,543	1,451	1,314	1,434
Stanford	1,634	50	1,684	36	1,648	1,648	1,541	1,370
Syracuse	3,183	225	3,408	101	3,307	3,248	3,204	2,207
Texas	1,935	734	2,669	130	2,539	2,597	1,446	785
Tulane	1,192	936	2,128	88	2,040	1,985	1,171	1,037
Virginia	804	.....	804	.....	804	688	757	638
Western Reserve	1,331	.....	1,331	.....	1,331	1,274	1,016	765
Wisconsin	3,956	1,536	5,492	477	5,015	4,745	3,876	3,221
Yale	3,224	.....	3,224	.....	3,224	3,287	3,466	2,990

[1] In all faculties, excluding preparatory or extension department.

[2] These figures do not include the registration in the two branch schools of agriculture, nor in any of the short courses, some of which were included in the previous years. The actual attendance in the fall of 1911 is practically identical with that of 1910.

[3] Certain classes of students counted in previous years must have been omitted in the total for 1911, since the institution reports a gain over 1910.

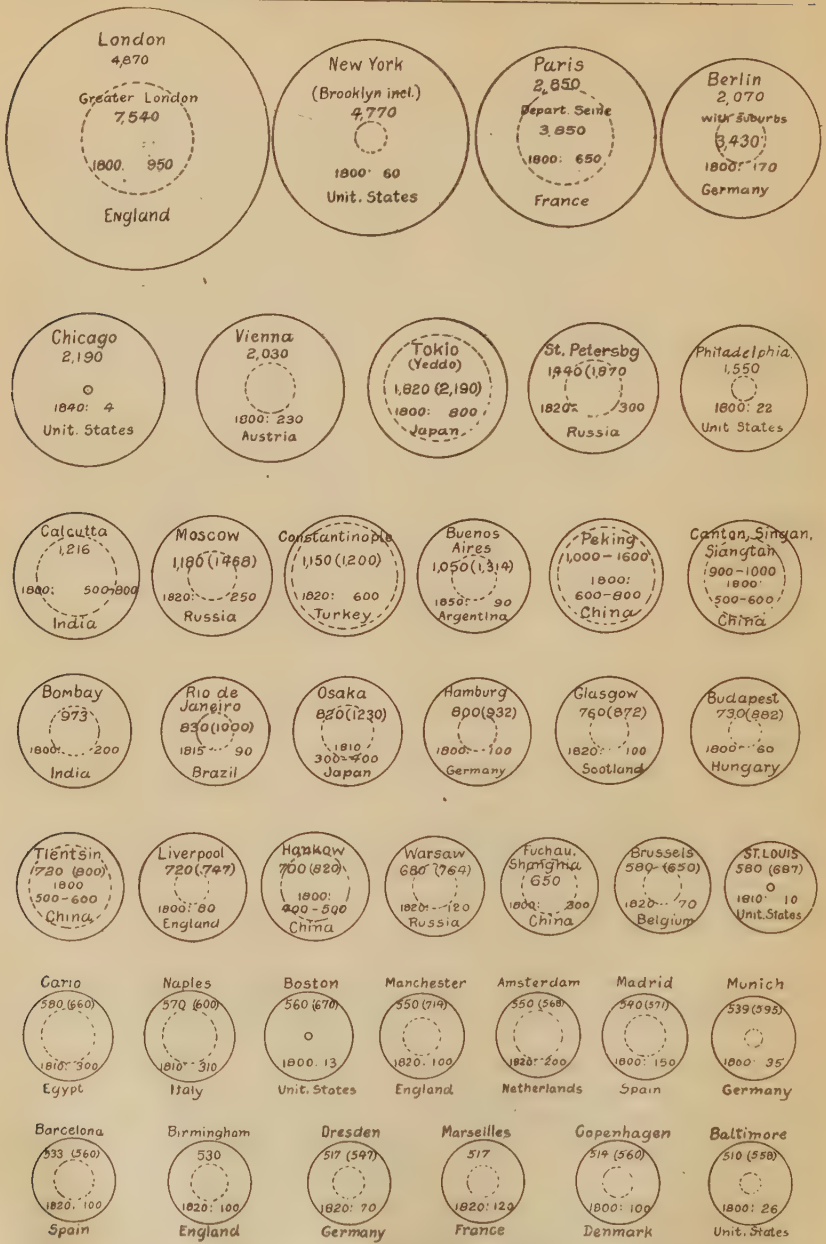
Training Schools for Nurses, Commercial Schools, Manual and Industrial Training Schools.

In the school year 1911 there were 1,118 training schools for nurses, having 29,762 students. There were also 600 commercial schools, having 155,244 students. There were 285 manual training schools, having 61,296 students; 115 reform schools took care of 51,387 of the wayward.

Insane in Institutions.

The number of insane persons in institutions in the United States in 1910 was 187,454, of which number 60,603 were committed during the year. Those discharged, dying, or transferred totaled 53,880. The number of persons committed to hospitals for the insane per 100,000 of population for the year 1910 was 65.9 and the total number of insane persons in institutions per 100,000 population was 203.8.

According to the latest figures the University of Paris is the largest university in the world with 17,000 students, after which follow Cairo with 10,000; Berlin, 9,600; Moscow, 9,000 and St. Petersburg, 9,000. The Asiatic universities are not considered in the above rating. Columbia is the largest university in the United States with 8,000 students followed by California with 5,724 and Cornell with 5,609.



PRINCIPAL TOWNS OF THE WORLD ACCORDING TO POPULATION.

The number of inhabitants (with suburbs) is given in thousands. The inner circles give the population 80 to 100 years ago.

CHAPTER II.

FARMS, FOODS AND FORESTS.

FARMS, FARM LAND, AND FARM PROPERTY OF THE UNITED STATES.

	1910 (April 15)	1900 (June 1)	INCREASE.[1] Amount.	Per cent.
Population	91,972,266	75,994,575	15,977,691	21.0
Urban population [2]	42,623,383	31,609,645	11,013,738	34.8
Rural population [3]	49,348,883	44,384,930	4,963,953	11.2
Number of all farms	**6,361,502**	**5,737,372**	**624,130**	**10.9**
Land area of the country.....acres.	1,903,289,600	1,903,461,760	−172,160	.....
Land in farms.....acres.	878,798,325	838,591,774	40,206,551	4.8
Improved land in farms.....acres.	478,451,750	414,498,487	63,953,263	15.4
Average acreage per farm	138.1	146.2	−8.1	−5.5
Average improved acreage per farm	75.2	72.2	3.0	4.2
Per cent of total land area in farms	46.2	44.1	.....	.....
Per cent of land in farms improved	54.4	49.4	.....	.....
Per cent of total land area improved	25.1	21.8	.....	.....
Value of farm property, total	**$40,991,449,090**	**$20,439,901,164**	**$20,551,547,926**	**100.5**
Land	28,475,674,169	13,058,007,995	15,417,666,174	118.1
Buildings	6,325,451,528	3,556,639,496	2,768,812,032	77.8
Implements and machinery	1,265,149,783	749,775,970	515,373,813	68.7
Domestic animals, poultry, and bees	4,925,173,610	3,075,477,703	1,849,695,907	60.1
Average value of all property per farm	$6,444	$3,563	$2,881	80.9
Average value of all property per acre of land in farms	46.64	24.37	22.27	91.4
Average value of land per acre	32.40	15.57	16.83	108.1

[1] A minus sign (−) denotes decrease.
[2] Population of incorporated places having, in 1910, 2,500 or more inhabitants. The figure for 1900 does not represent the urban population according to that census but is the population in that year of the territory classified as urban in 1910.
[3] Total, exclusive of urban.

NUMBER AND ACREAGE OF FARMS AND NUMBER OF ACRES IMPROVED AND UNIMPROVED.

[Source: Reports of the Bureau of the Census, Department of Commerce and Labor.]

Census year.	Number of farms.	Number of acres in farms. Improved.	Unimproved.	Total.	Average number of acres to a farm.	Per cent of farm land— Improved.	Unimproved.
1850	1,449,073	113,032,614	180,528,000	293,560,614	202.6	38.5	61.5
1860	2,044,077	163,110,720	244,101,818	407,212,538	199.2	40.1	59.9
1870 [1]	2,659,985	188,921,099	218,813,942	407,735,041	153.3	46.3	53.7
1880 [1]	4,008,907	284,771,042	251,310,793	536,081,835	133.7	53.1	46.9
1890 [1]	4,564,641	357,616,755	265,601,864	623,218,619	136.5	57.4	42.6
1900 [2]	5,737,372	414,498,487	424,093,287	838,591,774	146.2	49.4	50.6
1910 [3]	6,361,502	478,451,750	400,346,575	878,798,325	138.1	54.4	45.6

[1] Not including farms of less than 3 acres which reported the sale of less than $500 worth of products in the census year.
[2] Exclusive of Alaska and Hawaii.
[3] Exclusive of Alaska, Hawaii, and Porto Rico.

FARMS, FARM LAND, AND FARM PROPERTY OF THE UNITED STATES: 1850 TO 1910.

	1910	1900	1890	1880	1870	1860	1850
Population	91,972,266	75,994,575	62,947,714	50,155,783	38,558,371	31,443,321	23,191,876
Number of all farms	6,361,502	5,737,372	4,564,641	4,008,907	2,659,985	2,044,077	1,449,073
Land area of the country, acres	1,903,289,600	1,903,461,760	1,903,337,600	1,903,337,600	1,903,337,600	1,903,337,600	1,884,375,680
Land in farms, acres	878,798,325	838,591,774	623,218,619	536,081,835	407,735,041	407,212,538	293,560,614
Improved land in farms, acres	478,451,750	414,498,487	357,616,755	284,771,042	188,921,099	163,110,720	113,032,614
Average acreage per farm	138.1	146.2	136.5	133.7	153.3	199.2	202.6
Average improved acreage per farm	75.2	72.2	78.3	71.0	71.0	79.8	78.0
Per cent of total land area in farms	46.2	44.1	32.7	28.2	21.4	21.4	15.6
Per cent of land in farms improved	54.4	49.4	57.4	53.1	46.3	40.1	38.5
Per cent of total land area improved	25.1	21.8	18.8	15.0	9.9	8.6	6.0
Value of farm property, total	$40,991,449,090	$20,439,901,164	$16,082,267,689	$12,180,501,538	$8,944,857,749	$7,980,493,063	$3,967,343,580
Land and buildings	34,801,125,697	16,614,647,491	13,279,252,649	10,197,095,776	7,444,064,462	6,645,045,007	3,271,575,426
Implements and machinery	1,265,149,783	749,775,970	494,247,467	406,320,065	270,913,678	246,118,141	151,587,638
Domestic animals, poultry, and bees	4,925,173,610	3,075,477,703	2,308,767,573	1,576,884,707	1,229,889,609	1,089,329,915	544,180,516
Average value of all property per farm	$6,444	$3,563	$3,523	$3,038	$3,363	$3,904	$2,738
Average value of all property per acre of land in farms	46.64	24.37	25.81	22.72	21.94	19.60	13.51
Average value of land and buildings per acre	39.60	19.81	21.31	19.02	18.26	16.32	11.14

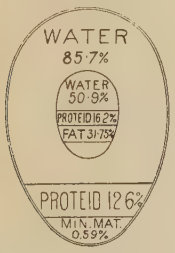
Loss of Constituents on Boiling.

PERCENTAGE COMPOSITION OF A POTATO, TURNIP AND STRAWBERRY.

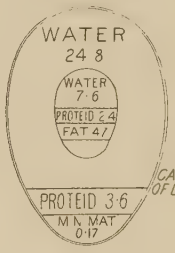
WEALTH PRODUCTION ON FARMS.

[Source: Reports of the Department of Agriculture.]

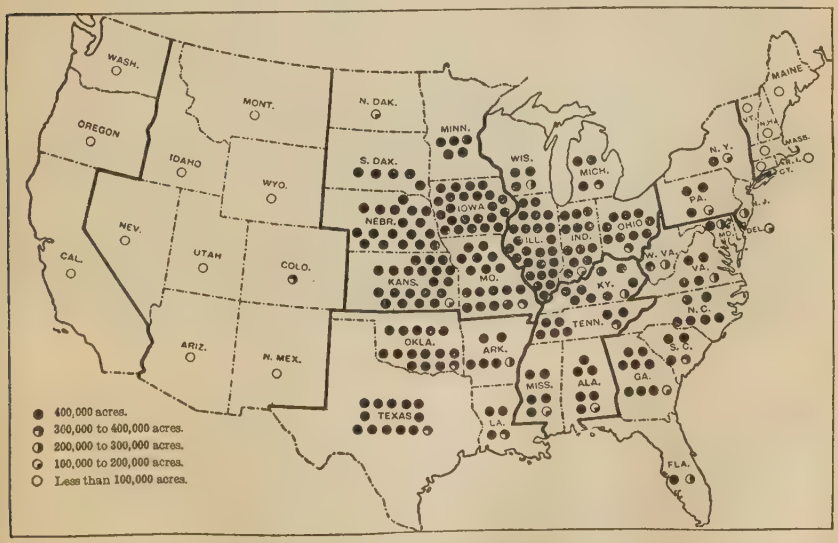
Calendar year.	Wealth production.	Calendar year.	Wealth production.
	Dollars.		*Dollars.*
1899	4,717,000,000	1906	6,755,000,000
1900	5,017,000,000	1907	7,488,000,000
1901	5,317,000,000	1908	7,778,000,000
1902	5,617,000,000	1909	8,760,000,000
1903	5,917,000,000	1910	8,694,000,000
1904	6,159,000,000	1911	8,417,000,000
1905	6,309,000,000		



PERCENTAGE COMPOSITION OF WHITE AND YOLK OF EGG.



ACTUAL COMPOSITION OF EGG.—WEIGHT 50 GMS.



CORN: ACREAGE BY STATES, 1909.

CEREAL CROPS: ESTIMATED PRODUCTION AND VALUE.

Commodity.	Total.			Average.		
	Area.	Production.	Farm Value Dec. 1.	Farm Value per bushel Dec. 1.	Yield per acre.	Farm Value of yield per acre.
	Acres.	Bushels.	Dollars.	Cents.	Bshls.	Dollars.
Corn:						
1866–75[1]..	32,715,700	969,947,600	454,534,800	47.8	26.1	12.48
1911.....	105,825,000	2,531,488,000	1,565,258,000	61.8	23.9	14.77
Wheat:						
1866–75[1]..	20,470,300	244,672,300	257,586,800	108.6	11.9	12.92
1911.....	49,543,000	621,338,000	543,063,000	87.4	12.5	10.93
Oats:						
1866–75[1]..	9,746,000	272,992,800	102,422,700	37.8	28.1	10.62
1911.....	37,763,000	922,298,000	414,663,000	45.0	24.4	10.98
Rye:						
1866–75[1]..	1,346,800	18,266,600	14,559,000	78.1	13.6	10.62
1911.....	2,127,000	33,119,000	27,557,000	83.2	15.6	12.98
Barley:						
1866–75[1]..	1,196,500	26,992,300	21,382,200	79.0	22.9	18.09
1911.....	7,627,000	160,240,000	139,182,000	86.9	21.0	18.25
Buckwheat:						
1866–75[1]..	729,900	13,368,800	9,735,200	72.5	18.3	13.27
1911.....	833,000	17,549,000	12,735,000	72.6	21.1	15.32

[1]Average per year for the period.
Statistical Abstract of the U. S.—Report of the Department of Agriculture.

WHEAT: ACREAGE BY STATES, 1909.

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THE ENORMOUS CROPS OF 1909.

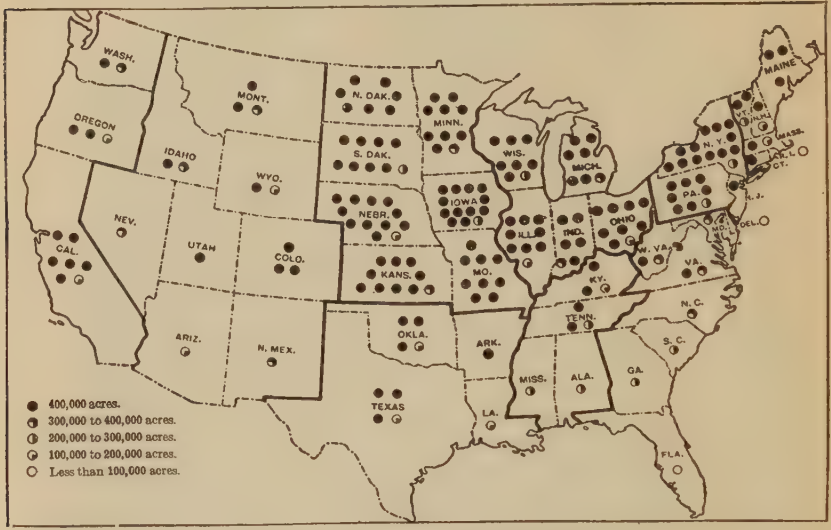
It piled up in Madison Square the crops of this year would completely swamp the Metropolitan tower.

OVER HALF THE CEREAL ACREAGE IN CORN.

In the United States as a whole a little more than one-half of the acreage devoted to cereals is in corn, a little less than one-fourth in wheat, and slightly less than one-sixth in oats. In each of the nine divisions, except the Pacific, the three leading cereals—corn, wheat, and oats—occupy, as in the United States at large, much more than three-fourths of the total cereal acreage. In the Pacific states the acreage of corn is insignificant, and that of barley exceeds that of oats. Corn occupies the leading place in the important cereal-producing regions, but in the New England and Middle Atlantic divisions the first place is held by oats, and in the Pacific and Mountain divisions by wheat.

HAY CROP: ESTIMATED ACREAGE, PRODUCTION, AND VALUE, 1911.

For the year 1911 the production of hay in the United States was 47,444,000 short tons, and the total acreage of land in hay was 43,017,000. The total farm value of the United States on December 1, 1911, was $694,570,000. The average price of hay per short ton on December 1, 1911 was $14.64, and the average yield per acre for the year was 1.10 short tons. The average farm value of yield per acre on December 1, 1911 was $16.10.



HAY AND FORAGE CROPS, 1909.

INITIATIVE AND REFERENDUM.

The "initiative" is a political device by which the people are enabled to pass laws or ordinances without change or modification by the ordinary legislative bodies. It has been called the positive or constructive side of direct legislation, just as the referendum, which enables the people to reject proposed laws, is the negative side. By this method a minority ranging in number from 5 to 25 per cent. may file a petition for a law, or, when a city, an ordinance. The measure must then, without change or revision, go before the people for their judgment, and, if it is approved by a majority of the votes cast, it becomes law without further process. Laws and ordinances so passed are not subject to veto.

The "referendum" may be defined as the submission of a proposed law, or ordinance, which has been passed by the people's representative in a legislature or council, to a vote of the people for ratification or rejection. It has been in use in a restricted form, in the United States for many years, especially in passing upon constitutions and constitutional amendments. It is only since 1898, however, that the referendum, in connection with the initiative, has been used as an instrument of direct legislation both by states and cities. The states which have adopted the initiative and referendum are Arkansas, California, Colorado, Illinois, Maine, Missouri, Montana, Oklahoma, Oregon, South Dakota and Utah. Nevada has adopted the referendum only.

THE RECALL.

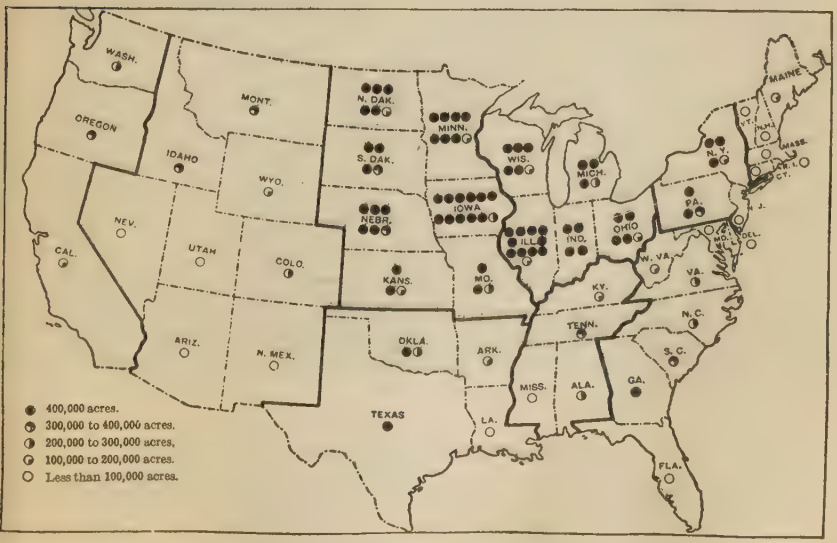
The "recall" is a method of procedure by which the people are enabled to remove from his position any public elective official at will. This requires a petition signed by a certain specified percentage or number of voters. The usual percentage in such cases is 25. In most cities under the commission form of government the recall of elective public officers is provided for through the filing of petitions signed by from 15 to 75 per cent. of the voters. In South Dakota cities the percentage is only 15, while in Illinois it is 55, and 33 in Louisiana. In Oregon all state officials, including judges and members of the legislature, are subject to the recall.—*Chicago Daily News Almanac*, 1912.

TOBACCO CROP IN CONTINENTAL UNITED STATES: 1911.

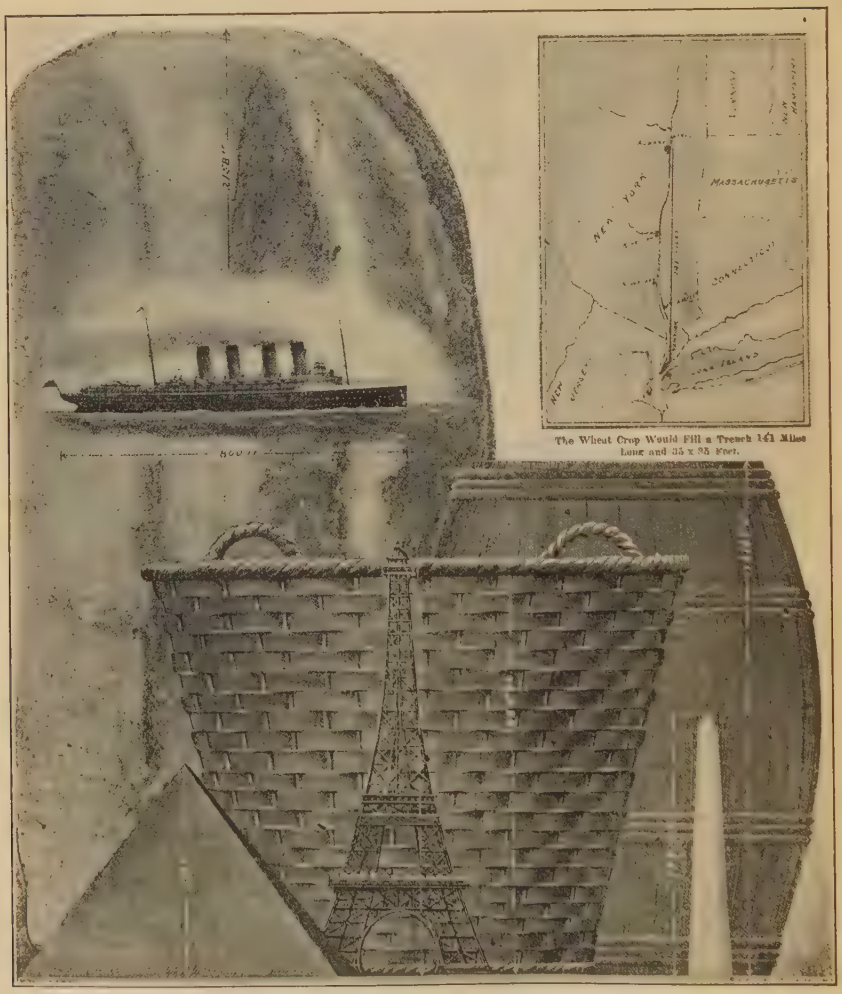
For the year 1911 there were 1,012,800 acres of land planted in tobacco, and the total product derived therefrom amounted to 905,109,000 pounds. The value of this product was estimated at $85,210,387. Kentucky ranked first in the tobacco producing states of the Union, West Virginia second, then followed, in their respective order, North Carolina, Ohio, Pennsylvania, Tennessee, Wisconsin, Indiana, Maryland, West Virginia, South Carolina, Massachusetts, New York, Missouri, and Illinois.

A YEAR'S CONSUMPTION OF TOBACCO
(in pounds per head)

A YEAR'S CROP OF TOBACCO
(per cwt., 112 pounds)



OATS: ACREAGE BY STATES, 1909.



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WHAT OUR WHEAT CROP MEANS.

The 735,260,970 bushel wheat crop of 1906 converted into a 1,214-foot barrel of flour, and baked into an immense loaf, 2,158 feet high.

WOOL PRODUCTION, CALENDAR YEAR 1911.

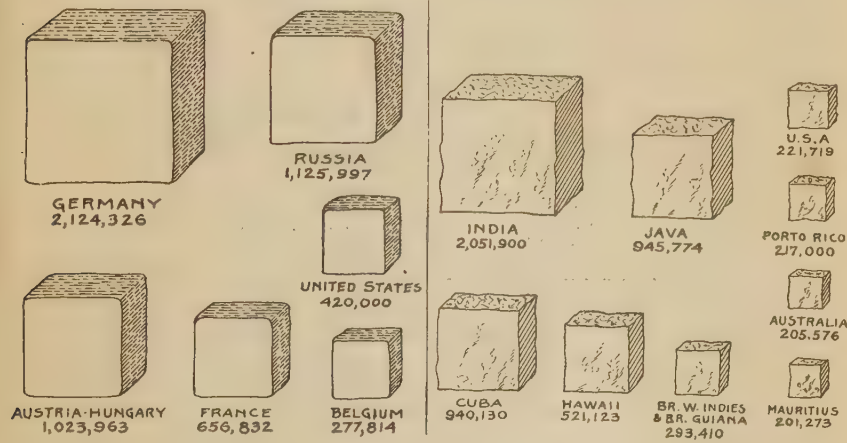
On April 1, 1911 the total number of sheep of shearing age was 39,761,000, and the average weight of a fleece for the year was 6.98 pounds. The per cent. of shrinkage for the same year was 60.4. For the same year there were 318,547,900 pounds of wool, washed and unwashed, and 139,896,195 pounds of scoured wool. The average value per pound of scoured wool for 1911 was 47.7 cents, and the total value of all the scoured wool to October 1, 1911 (Boston Market) was $66,591,017.

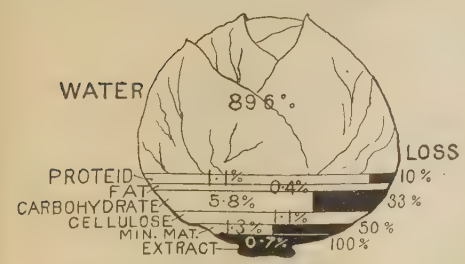
POTATO CROP: 1911.

For the year 1911 the total 3,619,000 acres planted to potatoes in the United States produced a total of 292,737,000 bushels of potatoes. Their total farm value on December 1, 1911 was $233,778,000, making the average price per bushel 79.9 cents. The average yield per acre for the whole United States was 80.8 bushels and the average farm value of yield per acre on December 1 was $64.64.

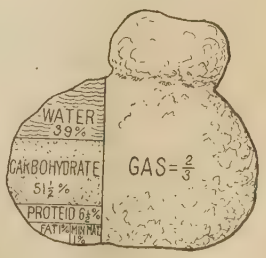
SUGAR BEETS.

During the year 1910 there were 61 sugar beet factories in operation. For the same period there were 398,029 acres of sugar beets harvested, and the average yield per acre was 10.17 short tons. The factories of the United States worked 4,047,292 short tons of beets and produced 1,020,344,000 pounds or 510,172 short tons of sugar. For the same period there were 696,640,000 pounds of cane sugar produced and 44,538,760 gallons of molasses.





Loss of Constituents on Boiling.

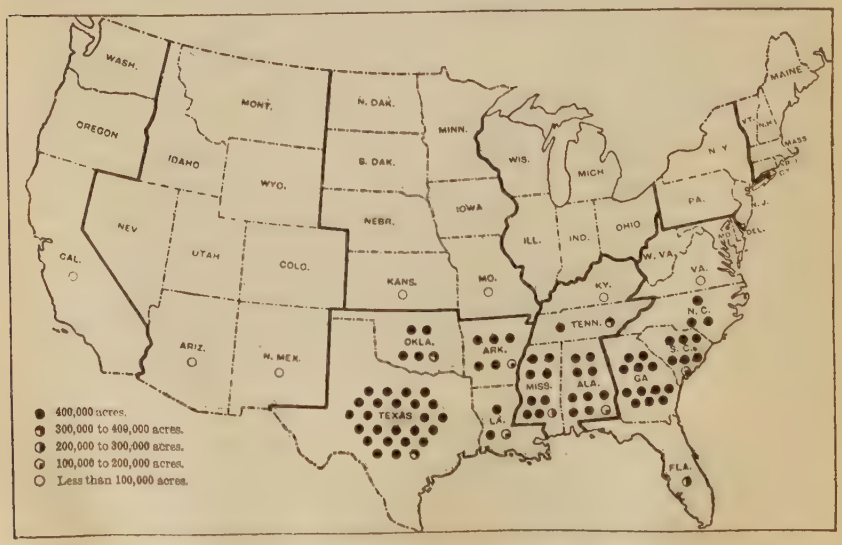


PERCENTAGE COMPOSITION OF CABBAGE AND BREAD.

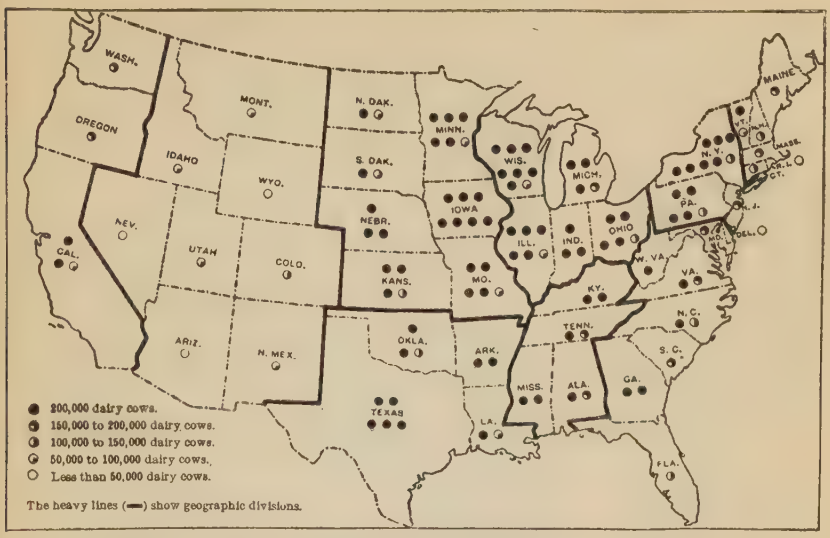
COTTON ACREAGE AND YIELD PER ACRE IN 1911, BY STATES.

State.	Area planted, 1911, revised.	Area picked, 1911.	Yield per acre, 1911.
	Acres.	*Acres.*	*Pounds.*
Virginia	44,000	43,000	330
North Carolina	1,657,000	1,624,000	315
South Carolina	2,800,000	2,800,000	280
Georgia	5,579,000	5,504,000	240
Florida	318,000	308,000	130
Alabama	4,043,000	4,017,000	204
Mississippi	3,426,000	3,340,000	172
Louisiana	1,118,000	1,075,000	170
Texas	11,150,000	10,943,000	186
Arkansas	2,470,000	2,363,000	190
Tennessee	850,000	837,000	257
Missouri	132,000	129,000	360
Oklahoma	3,081,000	3,050,000	160
California	13,000	12,000	390
United States	36,681,000	36,045,000	207.7

For the year 1909 the 32,043,838 acres of cotton harvested produced a total of 10,649,268 running bales. The total value was $703,619,303, making the average value per acre $21.96, and the average value per bale $66.07. The average yield per acre was 0.33 bales for the whole of the United States.



COTTON: ACREAGE BY STATES, 1909.



DAIRY COWS ON FARMS: NUMBER BY STATES, 1910.

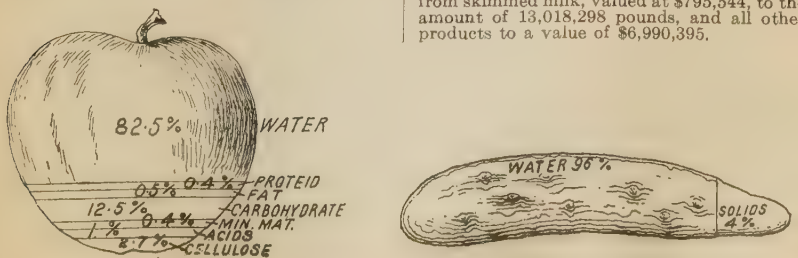
MILK, BUTTER AND CHEESE.

For the year 1909 the total cost of materials used in the production of butter, cheese, and condensed milk in factories, was $235,546,064. The 9,888,727,303 pounds of milk consumed, cost $118,675,613; the 1,406,143,908 pounds of cream, $95,025,507; the 56,974,760 pounds of skimmed milk, $110,469; the 78,457,978 pounds of sugar, $3,674,174; and all other materials cost $18,060,301.

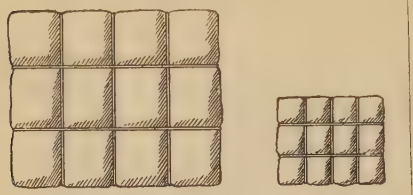
There were 1,620,766,000 pounds of butter, valued at $405,000,000 produced on farms and in factories in the United States during the census year 1909.

Of the grand total reported, the quantity produced on farms was 996,001,000 pounds, valued at $225,544,000. Factories produced 624,765,000 pounds, valued at $179,510,000. Butter manufactured by farmers' coöperative creameries is included in the figures for factories.

The 624,764,653 pounds of butter produced in factories, of which 410,692,616 were packed solid and 214,072,037 were in prints and rolls, were valued at $179,510,619; the 311,126,317 pounds of cheese, with a value of $43,239,924, were divided in the following proportion: full cream 287,110,383 pounds, value $40,817,073; part cream 10,803,392 pounds, value $1,188,000; skimmed 7,770,812 pounds, value $429,519; and other kinds 5,441,730 pounds, value $805,332. There were 494,796,544 pounds of condensed milk produced, with a total value of $33,563,129, of which amount 214,518,310 pounds, having a value of $17,345,278 were sweetened and 280,278,234 pounds, with a value of $16,217,851 were unsweetened. Besides these products the factories sold 81,211,374 pounds of cream, having a value of $9,828,972; 352,594,574 pounds of skimmed milk with a value of $629,135; casein dried from skimmed milk, valued at $795,544, to the amount of 13,018,298 pounds, and all other products to a value of $6,990,395.



PERCENTAGE COMPOSITION OF APPLE AND CUCUMBER.



A YEAR'S PRODUCTION OF COTTON.
(in lbs.)

Oleomargarine.

During the year 1911 a total quantity of 117,600,953 pounds of oleomargarine was produced in the United States. The internal revenue tax paid for this amount was $571,158.75; 2,842,629 pounds being taxed at the rate of ten cents a pound, and 114,758,324 pounds at one-fourth of one cent per pound.

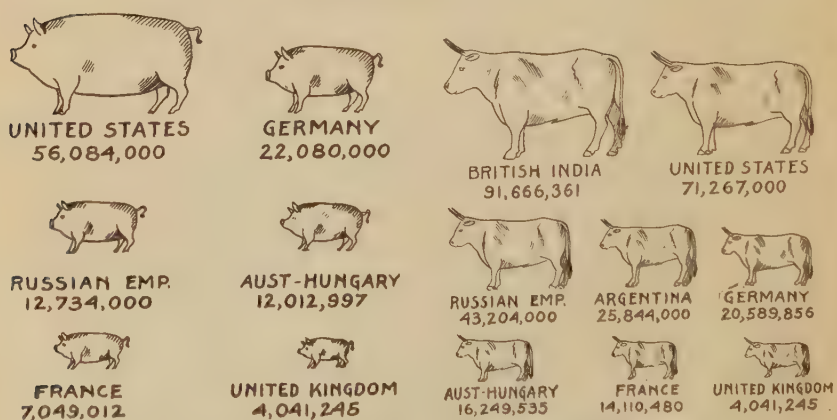
Bees.

According to the Census report for 1910 there were in the United States 3,445,006 colonies of bees, with a value of $10,373,615, or an average of $3.01 per colony. Nine and two-tenths per cent., or 585,955 farms in the United States, reported bee colonies.

Florist and Nursery Products.

In 1909 there were 10,614 florist establishments reporting products valued at $34,872,000.

The total value of nursery products reported from 5,582 establishments in 1909 was $21,051,000.



DISTRIBUTION OF FARM ANIMALS OF THE WORLD.
Figures vary somewhat from those given in Tables.

Cottonseed Products: Production and Manufacture, 1910.

During the year 1910 there were 5,175,000 short tons of cottonseed produced in the United States and of this amount 4,106,000 short tons were manufactured. The average value per ton of cottonseed used for manufacturing purposes was $27.40 per short ton. The cottonseed products, having a total value of $142,710,000, were as follows: Oil, 167,970,000 gallons with a value of $80,430,000; cake and meal, 1,792,000 short tons, with a value of $44,660,000; hulls, 1,375,000 short tons, with a value of $11,370,000; linters, 379,576 bales of 500 pounds net, with a value of $6,250,000.

Flaxseed Crop: 1911.

In 1911 the 2,757,000 acres planted to flaxseed produced a crop of 19,370,000 bushels. The total farm value on December 1, of that year, was $35,272,000, thus making the average price paid per bushel $1.82. The average yield per acre amounted to 7.0 bushels. The average farm value of yield per acre was $12.75.

COMPARISON OF FARM ANIMALS IN THE UNITED STATES.

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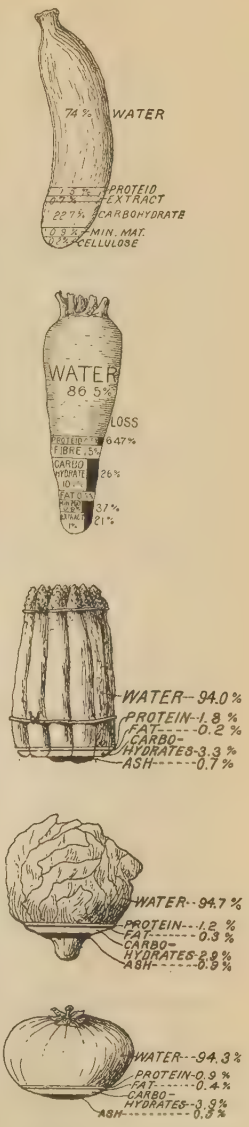


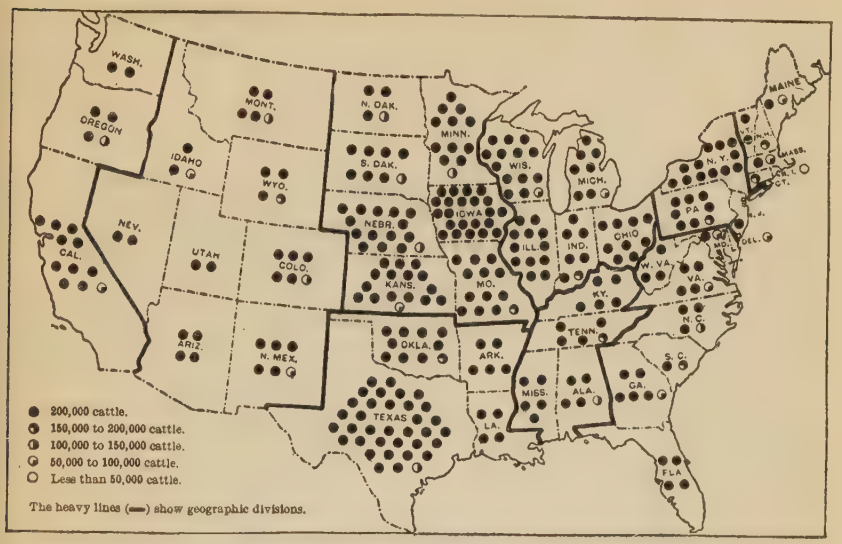
PERCENTAGE COMPOSITION OF BANANA, CARROT, ASPARAGUS, LETTUCE AND TOMATO.

NUMBER AND VALUE OF FARM ANIMALS, 1910.

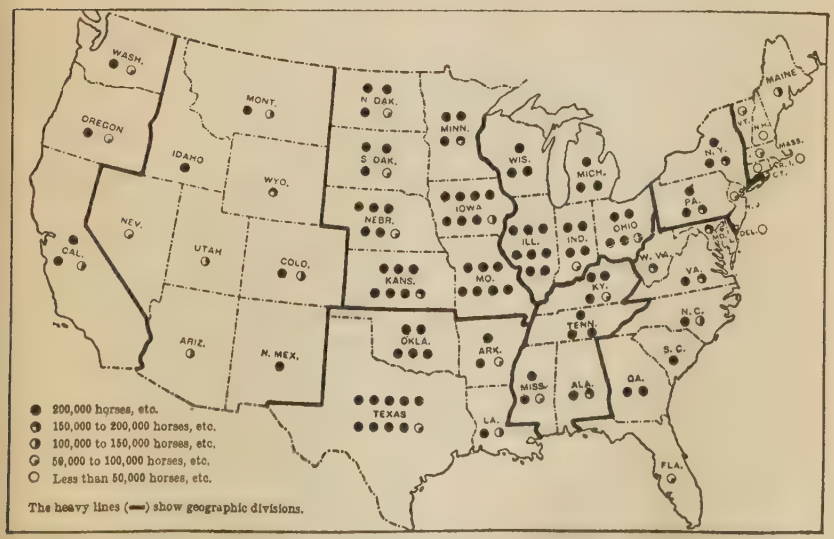
AGE AND SEX GROUP.	FARMS REPORTING.		ANIMALS.		
	Number.	Per cent of all farms.	Number.	Value.	Average value.
Total	6,017,142	94.9	.....	$4,731,182,929	.....
CATTLE	5,265,772	83.0	61,225,791	1,484,889,647	.....
Dairy cows (cows and heifers kept for milk, born before Jan. 1, 1909)	5,127,635	80.9	20,580,845	704,612,120	$34.24
Other cows (cows and heifers not kept for milk, born before Jan. 1, 1909)	1,440,383	22.7	11,788,473	263,123,294	22.32
Heifers born in 1909	2,372,305	37.4	7,253,450	102,533,205	14.14
Calves born after Jan. 1, 1910	2,647,484	41.8	7,757,935	51,599,629	6.65
Steers and bulls born in 1909	1,344,727	21.2	5,409,711	90,844,523	16.79
Steers and bulls born before Jan. 1, 1909	857,564	13.5	7,447,562	251,490,377	33.77
Class not specified	5,442	0.1	987,815	20,686,499	20.94
HORSES AND COLTS	4,671,441	73.7	19,731,060	2,076,297,828	.....
Mares, stallions, and geldings born before Jan. 1, 1909	4,647,632	73.3	17,344,916	1,951,808,485	112.53
Colts born in 1909	1,024,008	16.1	1,721,964	101,501,987	58.95
Colts born after Jan. 1, 1910	439,254	6.9	607,957	20,535,259	33.78
Class not specified	1,762	(1)	56,223	2,452,097	43.61
MULES AND MULE COLTS	1,861,474	29.4	4,183,572	522,402,080	.....
Mules born before Jan. 1, 1909	1,756,338	27.7	3,764,342	495,158,268	131.54
Mule colts born in 1909	167,612	2.6	310,869	22,738,798	73.15
Mule colts born after Jan. 1, 1910	86,671	1.4	108,361	4,505,014	41.57
ASSES AND BURROS (all ages)	43,233	0.7	101,392	13,092,867	129.13
SWINE	4,340,592	68.5	58,000,632	398,002,878	.....
Hogs and pigs born before Jan. 1, 1910	4,082,606	64.4	35,015,408	350,981,488	10.02
Pigs born after Jan. 1, 1910	1,863,651	29.4	22,985,224	47,021,390	2.05
SHEEP AND LAMBS	609,323	9.6	51,809,068	230,532,817	.....
Ewes born before Jan. 1, 1910	589,415	9.3	31,582,097	163,421,183	5.17
Rams and wethers born before Jan. 1, 1910	296,113	4.7	7,604,672	38,198,173	5.02
Lambs born after Jan. 1, 1910	469,031	7.4	12,622,299	28,913,461	2.29
GOATS AND KIDS (all ages)	83,445	1.3	2,798,160	5,964,812	2.13

VALUE OF FARM ANIMALS AND POULTRY, 1910.

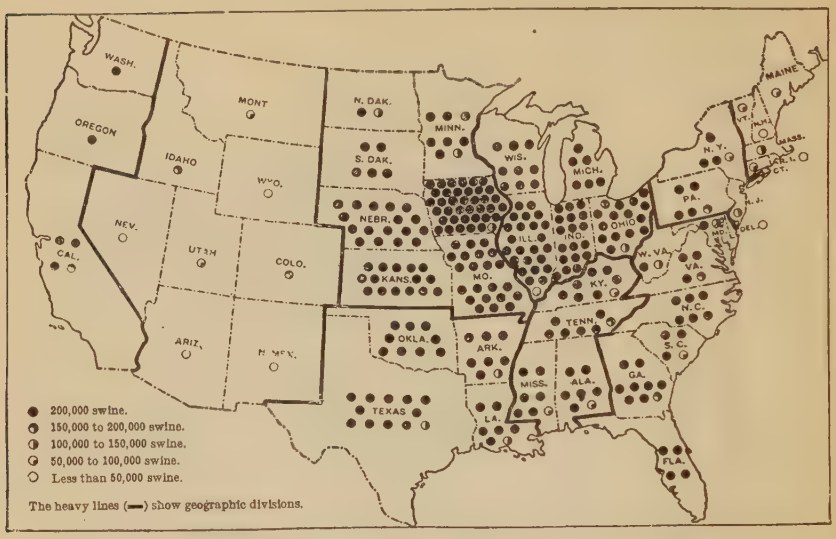
KIND.	1910 (Apr. 15).		1900 (June 1).		INCREASE.	
	Value.	Per cent distribution.	Value.	Per cent distribution.	Amount.	Per cent.
Total	$4,894,948,782	100.0	$3,075,132,266	100.0	$1,819,816,516	59.2
Cattle	1,484,889,647	30.3	1,475,204,633	48.0	9,685,014	0.7
Horses and colts	2,076,297,828	42.4	896,513,217	29.2	1,179,784,611	131.6
Mules and mule colts	522,402,080	10.7	196,222,053	6.4	326,180,027	166.2
Asses and burros	13,092,867	0.3	5,811,184	0.2	7,281,683	125.3
Swine	398,002,878	8.1	231,978,031	7.5	166,024,847	71.6
Sheep and lambs	230,532,817	4.7	170,203,119	5.5	60,329,698	35.4
Goats and kids	5,964,812	0.1	3,265,349	0.1	2,699,463	82.7
Poultry	153,394,142	3.1	85,756,593	2.8	67,637,549	78.9
Bees	10,371,711	0.2	10,178,087	0.3	193,624	1.9



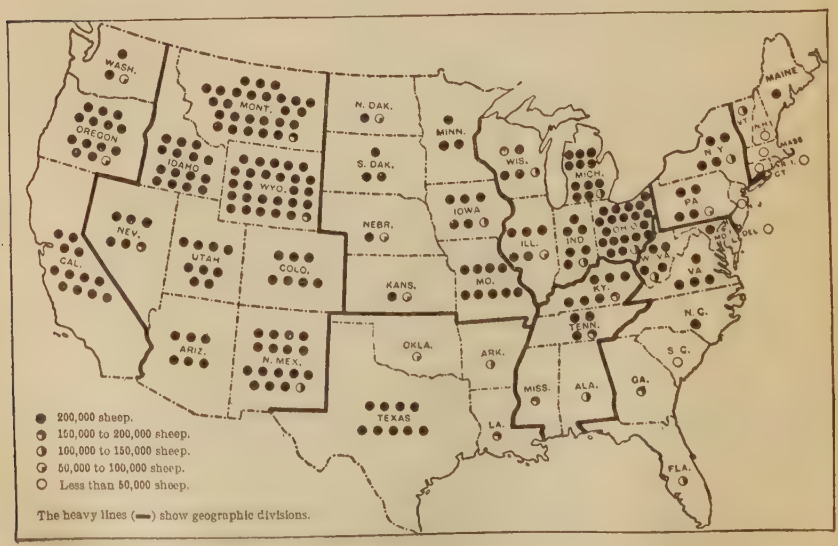
ALL CATTLE ON FARMS: NUMBER BY STATES, 1910.



ALL HORSES, MULES AND ASSES AND BURROS ON FARMS: NUMBER BY STATES, 1910.



ALL SWINE ON FARMS: NUMBER BY STATES, 1910.

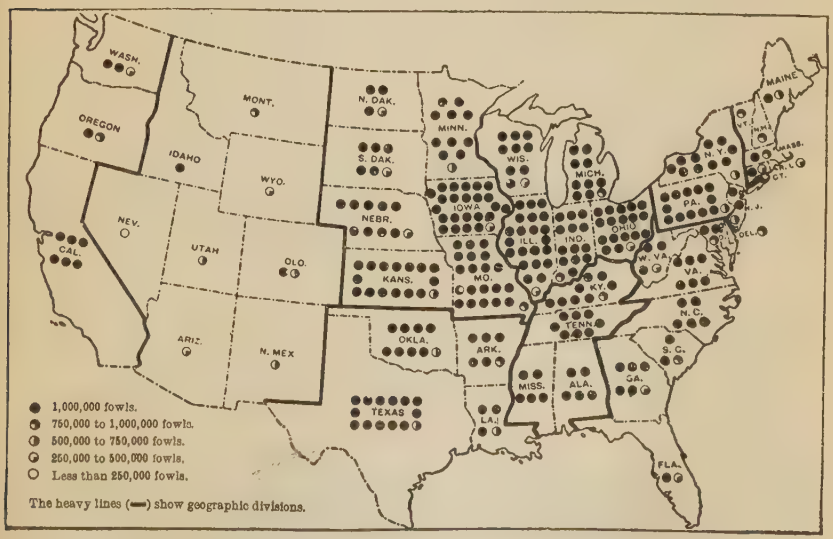


ALL SHEEP ON FARMS: NUMBER BY STATES, 1910.

NUMBER AND VALUE OF POULTRY IN THE UNITED STATES, 1910.

KIND.	1910 (Apr. 15). Farms reporting. Number.	Farms reporting. Per cent of all farms.	Number of fowls.	Value.	1900 (June 1). Number of fowls.
Total	5,585,012	88.1	295,876,176	$153,394,142	250,623,354
Chickens	5,577,218	88.0	280,340,643	140,192,912	233,566,021
Turkeys	852,679	13.4	3,688,688	6,605,640	6,594,695
Ducks	503,673	7.9	2,904,359	1,566,176	4,785,850
Geese	661,189	10.4	4,431,623	3,192,861	5,676,788
Guinea fowls	339,922	5.4	1,765,033	613,282	(1)
Pigeons	99,409	1.6	2,730,996	762,372	(2)
All other [3]	2,005	(3)	14,834	460,899	(2)

[1] Included with chickens. [2] Not reported. [3] Less than one-tenth of 1 per cent.



ALL FOWLS ON FARMS: NUMBER BY STATES, 1910.

Rice Crop, 1911.

For the year 1911 the total 696,300 acres planted to rice in the United States produced a total of 22,934,000 bushels of rice. The total farm value on December 1, 1911 was $18,274,000, making the average price per bushel 79.7 cents. The average yield per acre was 32.9 for whole of the United States.

Hops: 1911.

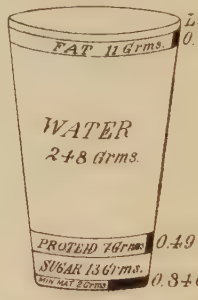
The total production of hops in the United States in 1911 amounted to 40,000,000 lbs., as against 44,000,000 lbs. in 1910, or 27.2 per cent. of the world's production. During 1910, the exports amounted to 12,748,617 lbs. and the imports to 5,823,526.

Egg Statistics.

According to a recent report of the Census Bureau, the production of eggs on farms of the United States in 1909 was 1,591 million dozen, valued at $306,689,000, equivalent to 19.3 cents per dozen. This production is equivalent to 207 eggs per capita of population. As less than 1 per cent. of the eggs produced are exported and almost none imported, production may be regarded as equivalent to domestic consumption. In the fiscal year ending June 30, 1910, the exports of eggs were 5,326,000 dozen and imports 818,000 dozen. A small proportion of the production is used for manufacturing purposes. The census report does not include the production of eggs in cities, towns, or villages. According to an estimate given in the census report of 1900, the production of eggs off farms was equal to about 5 per cent. of the production on farms; on this basis, about 80 million dozen eggs would have been produced off farms in 1909.

According to the census figures the production of eggs increased 23 per cent. from 1899 to 1909; but the commercial movement shows a much greater increase. Seven cities combined (New York, Boston, Chicago, St. Louis, Cincinnati, Milwaukee, and San Francisco) received about 369 million dozen eggs in 1909, an increase of 70 per cent. over their receipts in 1899. Population had increased between 1900 and 1910 about 21 per cent. in the United States, but 31 per cent. in the seven cities named above. The receipts at these seven cities in 1909 were equivalent to about 23 per cent. of the production as reported by the census, as compared with 16 per cent. in 1899.

In January, 1910, and again in June, 1910, the Department of Agriculture made an investigation through its agents, in 63 cities throughout the United States, concerning the price which retail dealers were paying for eggs and the price which consumers were paying for fresh eggs; at the same time inquiries were made through correspondence with crop reporters of the Bureau of Statistics adjacent to these cities concerning the prices received by producers. From the reports received it appears that in June, 1910, consumers paid an average of 24 cents per dozen; retail dealers paid 19.8 cents, and near-by producers received 18.7 cents; in January, 1910, consumers paid 38.1 cents, retailers paid 32 cents, and near-by producers received 30.4. The average price to producers for the entire United States in the middle of June, 1910, was about 18.3 cents, and in the last week of January, 1910, about 29 cents.



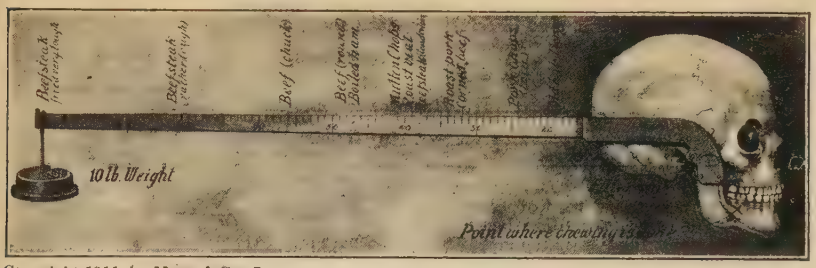
COMPOSITION OF MILK.

It has been estimated that the average man must be supplied daily with an amount of energy in the form of food which is the equivalent of from 3,000 to 3,500 calories. In order to obtain this energy one would have to consume about eight pints of milk daily, or about a tumblerful every hour of the working day.

ORCHARD AND VINEYARD PRODUCTS.

Products.	Trees of Bearing Age: 1910.		Products of 1909.		Trees Reported June 1, 1900.	Products of 1899. Bushels.
	Farms reporting.	Number.	Bushels.	Value.		
Fruits: (orchard)						
Apples	2,980,398	151,323,000	147,522,000	$83,231,000	201,794,000	175,397,000
Cherries	1,248,667	11,822,044	4,126,099	7,231,160	11,943,287	2,873,499
Peaches	1,843,610	94,507,000	35,470,000	28,781,000	99,919,000	15,434,000
Pears	1,276,366	15,172,000	8,841,000	7,911,000	17,716,000	6,625,000
Plums, etc	1,120,130	23,445,009	15,480,170	10,299,495	30,780,892	8,764,032
Fruits: (vineyard)						
Grapes	923,396	224,098,000	2,570,996,000	22,025,000	182,228,000	1,300,751,000
Fruits: (sub-tropical)						
Oranges	.....	9,367,047	[1]9,289,391	17,257,278	.....	.....
Lemons	.....	938,870	2,728,341	2,939,512	.....	.....

[1]Boxes.



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JAW LEVERAGE REQUIRED FOR VARIOUS MEATS.

CUTS OF MEAT.

The method of dividing up the carcasses of slaughtered animals varies considerably in different localities. In order that there may be no confusion on this account the character of the cuts of beef, veal, pork and mutton is shown in the diagrams given on page 62.

THE FUNCTIONS AND USES OF FOODS.

BY C. F. LANGWORTHY, PH. D.
Office of Experiment Stations.

In this article a number of the terms used in discussing food are defined and some of the principles of nutrition are briefly stated. The average composition of a number of the more common American foods is quoted as well as the commonly accepted dietary standards. With the aid of such data, the nutritive value of any given diet may be computed and its comparative value ascertained.

Ordinary food materials, such as meat, fish, eggs, potatoes, wheat, etc., consist of:

Refuse.—As the bones of meat and fish, shells of shellfish, skins of potatoes, bran of wheat, etc.

Edible Portion.—As the flesh of meat and fish, the white and yolk of eggs, wheat flour, etc. The edible portion consists of water and nutritive ingredients, or nutrients. The nutritive ingredients are *protein, fats, carbohydrates* and *mineral matters.*

The water, refuse, and salt of salted meat and fish are called non-nutrients. In comparing the values of different food materials for nourishment they are left out of account.

USE OF NUTRIENTS.

Food is used in the body to build and repair tissue and to furnish energy. The manner in which the valuable constituents are utilized in the body may be expressed in tabular form as follows:

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THE RACE OF FOODS FOR FIRST PLACE IN THE DIGESTION RACE.

Protein	Forms tissue (muscles, tendon, and probably fat).	All serve as *fuel* and yield *energy* in form of heat and muscular strength.
White (albumen) of eggs, curd (casein) of milk, lean meat, gluten of wheat, etc.		
Fats	Form fatty tissue.	
Fat of meat, butter, olive oil, oils of corn and wheat, etc.		
Carbohydrates	Transformed into fat.	
Sugar, starch, etc.		
Mineral matters (ash)	Aid in forming bone, assist in digestion, etc.	
Phosphates of lime, potash, soda, etc.		

The Fuel Value of Food.—Heat and muscular power are forms of force or energy. The energy is developed as the food is consumed in the body. The unit commonly used in this measurement is the calorie, the amount of heat which would raise the temperature of a pound of water 4 deg. Fahrenheit.

Instead of this unit some unit of mechanical energy might be used—for

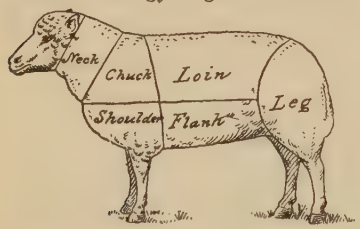


DIAGRAM OF CUTS OF MUTTON.

instance, the foot-ton, which represents the force required to raise one ton one foot. One calorie is equal to very nearly 1.53 foot-tons.

The following general estimate has been made for the average amount of potential energy in 1 pound of each of the classes of nutrients:

	Calories.
In 1 pound of protein	1,860
In 1 pound of fats	4,220
In 1 pound of carbohydrates	1,860

In other words, when we compare the nutrients in respect to their fuel values, their capacities for yielding heat and mechanical power,

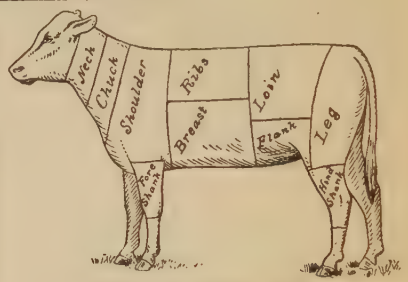


DIAGRAM OF CUTS OF VEAL.

a pound of protein of lean meat or albumen of egg is just about equivalent to a pound of sugar or starch, and a little over two pounds of either would

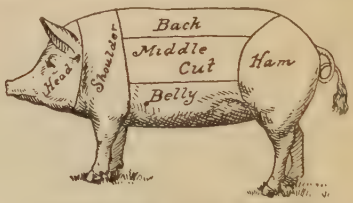


DIAGRAM OF CUTS OF PORK.

be required to equal a pound of the fat of meat or butter or the body fat.

Within recent years analyses of a large number of samples of foods have been made in this country. In the tables on pages 63–65 the results of a number of these analyses are given:

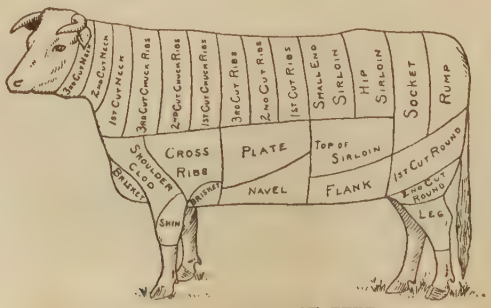


DIAGRAM OF CUTS OF BEEF.

AVERAGE COMPOSITION OF AMERICAN FOOD PRODUCTS.

Food Materials (as purchased).	Refuse.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel Value per Lb.
ANIMAL FOOD.							
Beef, fresh:	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Calories.
Chuck, including shoulder	17.3	54.0	15.8	12.5	.....	0.7	820
Chuck ribs	19.1	53.8	15.3	11.1	.....	.8	755
Flank	5.5	56.1	18.6	19.9	.....	.8	1,185
Loin	13.3	52.9	16.4	16.9	.....	.9	1,020
Porterhouse steak	12.7	52.4	19.1	17.9	.....	.8	1,110
Sirloin steak	12.8	54.0	16.5	16.1	.....	.9	985
Neck	31.2	45.3	14.2	9.2	.....	.7	650
Ribs	20.1	45.3	14.4	20.0	.....	.7	1,110
Rib rolls	.....	64.8	19.4	15.5	.....	.9	1,015
Round	8.5	62.5	19.2	9.2	.....	1.0	745
Rump	19.0	46.9	15.2	18.6	.....	.8	1,065
Shank, fore	38.3	43.2	13.2	5.2	.....	.6	465
Shoulder and clod	17.4	57.0	16.5	8.4	.....	.9	660
Fore quarter	20.6	49.5	14.4	15.1	.....	.7	905
Hind quarter	16.3	52.0	16.1	15.4	.....	.8	950
Beef, corned, canned, pickled, and dried:							
Corned beef	8.4	49.2	14.3	23.8	.....	4.6	1,271
Tongue, pickled	6.0	58.9	11.9	19.2	.....	4.3	1,030
Dried, salted, and smoked	4.7	53.7	26.4	6.9	.....	8.9	780
Canned boiled beef	.....	51 8	25.5	22.5	.....	1.3	1,425
Canned corned beef	.....	51.8	26.3	18.7	.....	4.0	1,280
Veal:							
Breast	23.3	52.5	15.7	8.2	.....	.8	635
Leg	11.7	63.4	18.3	5.8	.....	1.0	585
Leg cutlets	3.4	68.3	20.1	7.5	.....	1.0	690
Fore quarter	24.5	54.2	15.1	6.0	.....	.7	535
Hind quarter	20.7	56.2	16.2	6.6	.....	.8	580
Mutton:							
Flank	9.9	39.0	13.8	36.9	.....	.6	1,815
Leg, hind	17.7	51.9	15.4	14.5	.....	.8	900
Shoulder	22.1	46.8	13.7	17.1	.....	.7	975
Fore quarter	21.2	41.6	12.3	24.5	.....	.7	1,265
Hind quarter, without tallow	19.3	43 3	13.0	24.0	.....	.7	1,255
Lamb:							
Breast	19.1	45.5	15.4	19.1	.....	.8	1,090
Leg, hind	13.8	50.3	16.0	19.7	.....	.9	1,130
Pork, fresh:							
Flank	18.0	48.5	15.1	18.6	.....	.7	1,065
Ham	10.3	45.1	14.3	29.7	.....	.8	1,520
Loin chops	19.3	40.8	13.2	26.0	.....	.8	1,340
Shoulder	12.4	44.9	12.0	29.8	.....	.7	1,480
Tenderloin	.....	66.5	18.9	13.0	.....	1.0	900
Pork, salted, cured, and pickled:							
Ham, smoked	12.2	35.8	14.5	33.2	.....	4.2	1,670
Shoulder, smoked	18.9	30.7	12.6	33.0	.....	5.0	1,625
Salt pork	.....	7.9	1.9	86.2	.....	3.9	3,670
Bacon, smoked	8.7	18.4	9.5	59.4	.....	4.5	2,685
Sausage:							
Bologna	3.3	55.2	18.2	19.7	.....	3.8	1,170
Farmer	3.9	22.2	27.9	40.4	.....	7.3	2,225
Frankfort	.....	57.2	19.6	18.6	1.1	3.4	1,170
Soups:							
Celery, cream of	.....	88.6	2.1	2.8	5.0	1.5	250
Beef	.....	92.9	4.4	.4	1.1	1.2	120
Meat stew	.....	84.5	4.6	4.3	5.5	1.1	370
Tomato	.....	90.0	1.8	1.1	5.6	1.5	185
Poultry:							
Chicken, broilers	41.6	43.7	12.8	1.4	.....	.7	295
Fowls	25.9	47.1	13.7	12.3	.....	.7	775
Goose	17.6	38.5	13.4	29.8	.....	.7	1,505
Turkey	22.7	42.4	16.1	18.4	.....	.8	1,075
Fish:							
Cod, dressed	29.9	58.5	11.1	.2	.....	.8	215
Halibut, steaks or sections	17.7	61.9	15.3	4.4	.....	.9	470
Mackerel, whole	44.7	40.4	10.2	4.2	.....	.7	365
Perch, yellow, dressed	35.1	50.7	12.8	.7	.....	.9	265
Shad, whole	50 1	35.2	9.4	4.8	.....	.7	380
Shad, roe	.....	71.2	20.9	3.8	2.6	1.5	600
Fish, salt: Cod	24.9	40.2	19.0	.4	.....	18.5	315

AVERAGE COMPOSITION OF AMERICAN FOOD PRODUCTS—*Continued.*

Food Materials (as purchased).	Refuse.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel Value per Lb.
	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Calories.
Fish, canned:							
Salmon	14.2	56.8	19.5	7.5	.....	2.0	680
Sardines	[1] 5.0	53.6	23.7	12.1	.....	5.3	950
Shellfish:							
Oysters, "solids"	.....	88.3	6.0	1.3	3.3	1.1	230
Clams	.....	80.8	10.6	1.1	5.2	2.3	340
Crabs	52.4	36.7	7.9	.9	.6	1.5	195
Lobsters	61.7	30.7	5.9	.7	.2	.8	140
Eggs: Hens' eggs	[2] 11.2	65.5	11.9	9.3	.....	.9	635
Dairy products, etc.:							
Butter	.....	11.0	1.0	85.0	.....	3.0	3,605
Whole milk	.....	87.0	3.3	4.0	5.0	.7	325
Skim milk	.....	90.5	3.4	.3	5.1	.7	170
Buttermilk	.....	91.0	3.0	.5	4.8	.7	165
Condensed milk	.....	26.9	8.8	8.3	54.1	1.9	1,520
Cream	.....	74.0	2.5	18.5	4.5	.5	910
Cheese, Cheddar	.....	27.4	27.7	36.8	4.1	4.0	2,145
Cheese, full cream	.....	34.2	25.9	33.7	2.4	3.8	1,950
VEGETABLE FOOD.							
Flour, meal, etc.:							
Entire-wheat flour	.....	11.4	13.8	1.9	71.9	1.0	1,675
Graham flour	.....	11.3	13.3	2.2	71.4	1.8	1,670
Wheat flour, patent roller process—							
High-grade and medium	.....	12.0	11.4	1.0	75.1	.5	1,650
Low grade	.....	12.0	14.0	1.9	71.2	.9	1,665
Macaroni	.....	78.4	3.0	1.5	15.8	1.3	415
Crushed wheat	.....	10.1	11.1	1.7	75.5	1.6	1,685
Buckwheat flour	.....	13.6	6.4	1.2	77.9	.9	1,620
Corn meal	.....	12.5	9.2	1.9	75.4	1.0	1,655
Oatmeal	.....	7.3	16.1	7.2	67.5	1.9	1,860
Rice	.....	12.3	8.0	.3	79.0	.4	1,630
Tapioca	.....	11.4	.4	.1	88.0	.1	1,650
Starch	.....	.....	.....	.....	90.0	.....	1,675
Bread, pastry, etc.:							
White bread	.....	35.3	9.2	1.3	53.1	1.1	1,215
Brown bread	.....	43.6	5.4	1.8	47.1	2.1	1,050
Graham bread	.....	35.7	8.9	1.8	52.1	1.5	1,210
Whole-wheat bread	.....	38.4	9.7	.9	49.7	1.3	1,140
Rye bread	.....	35.7	9.0	.6	53.2	1.5	1,180
Cake	.....	19.9	6.3	9.0	63.3	1.5	1,675
Cream crackers	.....	6.8	9.7	12.1	69.7	1.7	1,990
Oyster crackers	.....	4.8	11.3	10.5	70.5	2.9	1,965
Soda crackers	.....	5.9	9.8	9.1	73.1	2.1	1,925
Sugars, etc.:							
Molasses	.....	25.1	2.4	.....	69.3	3.2	1,290
Candy	.....	.....	.....	.....	96.0	.....	1,785
Honey [3]	.....	18.2	.4	.....	81.2	.2	1,520
Sugar, granulated	.....	.....	.....	.....	100 0	.....	1,800
Maple sirup	.....	.....	.....	.....	71.4	.....	1,330
Vegetables: [4]							
Beans, dried	.....	12.6	22.5	1.8	59.6	3.5	1,605
Beans, Lima, shelled	.....	68.5	7.1	.7	22.0	1.7	570
Beans, string	7.0	83.0	2.1	.3	6.9	.7	180
Beets	20.0	70.0	1.3	.1	7.7	.9	170
Cabbage	15.0	77.7	1.4	.2	4.8	.9	125
Celery	20.0	75.6	.9	.1	2.6	.8	70
Corn, green (sweet), edible portion	.....	75.4	3.1	1.1	19.7	.7	470
Cucumbers	15.0	81.1	.7	.2	2.6	.4	70
Lettuce	15.0	80.5	1.0	.2	2.5	.8	75
Mushrooms	.....	88.1	3 5	.4	6.8	1.2	210
Onions	10.0	78.9	1.4	.3	8.9	.5	205
Parsnips	20.0	66.4	1.3	.4	10.8	1.1	240
Peas (*Pisum sativum*), dried	.....	9.5	24.6	1.0	62.0	2.9	1,655

[1] Refuse, oil. [2] Refuse, shell.

[3] Contained on an average cane sugar 2.8 and reducing sugar 71.1 per cent. The reducing sugar was composed of about equal amounts of glucose (dextrose) and fruit sugar (levulose).

[4] Such vegetables as potatoes, squash, beets, etc., have a certain amount of inedible material, skin, seeds, etc. The amount varies with the method of preparing the vegetables, and cannot be accurately estimated. The figures given for refuse of vegetables, fruits, etc., are assumed to represent approximately the amount of refuse in these foods as ordinarily prepared.

AVERAGE COMPOSITION OF AMERICAN FOOD PRODUCTS—*Continued.*

Food Materials (as purchased).	Refuse.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel Value per Lb.
Vegetables—(*Continued*):	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Calories.
Peas (*Pisum sativum*), shelled	.....	74.6	7.0	0.5	16.9	1.0	465
Cowpeas, dried	.....	13.0	21.4	1.4	60.8	3.4	1,590
Potatoes	20.0	62.6	1.8	.1	14.7	.8	310
Rhubarb	40.0	56.6	.4	.4	2.2	.4	65
Sweet potatoes	20.0	55.2	1.4	.6	21.9	.9	640
Spinach	.....	92.3	2.1	.3	3.2	2.1	110
Squash	50.0	44.2	.7	.2	4.5	.4	105
Tomatoes	.....	94.3	.9	.4	3.9	.5	105
Turnips	30.0	62.7	.9	.1	5.7	.6	125
Vegetables, canned:							
Peas (*Pisum sativum*), green	.....	85.3	3.6	.2	9.8	1.1	255
Corn, green	.....	76.1	2.8	1.2	19.0	.9	455
Tomatoes	.....	94.0	1.2	.2	4.0	.6	105
Fruits, berries, etc., fresh:[1]							
Apples	25.0	63.3	.3	.3	10.8	.3	220
Bananas	35.0	48.9	.8	.4	14.3	.6	300
Grapes	25.0	58.0	1.0	1.2	14.4	.4	335
Lemons	30.0	62.5	.7	.5	5.9	.4	145
Muskmelons	50.0	44.8	.3	.....	4.6	.3	90
Oranges	27.0	63.4	.6	.1	8.5	.4	170
Pears	10.0	76.0	.5	.4	12.7	.4	260
Persimmons, edible portion	.....	66.1	.8	.7	31.5	.9	630
Raspberries	.....	85.8	1.0	.....	12.6	.6	255
Strawberries	5.0	85.9	.9	.6	7.0	.6	175
Watermelons	59.4	37.5	.2	.1	2.7	.1	60
Fruits, dried:							
Apples	.....	28.1	1.6	2.2	66.1	2.0	1,350
Apricots	.....	81.4	.9	.....	17.3	.4	340
Dates	10.0	13.8	1.9	2.5	70.6	1.2	1,450
Figs	.....	18.8	4.3	.3	74.2	2.4	1,475
Nuts:							
Almonds	45.0	2.7	11.5	30.2	9.5	1.1	1,660
Beechnuts	40.8	2.3	13.0	34.0	7.8	2.1	1,820
Brazil nuts	49.6	2.6	8.6	33.7	3.5	2.0	1,655
Butternuts	86.4	.6	3.8	8.3	.5	.4	430
Chestnuts, fresh	16.0	37.8	5.2	4.5	35.4	1.1	945
Chestnuts, dried	24.0	4.5	8.1	5.3	56.4	1.7	1,425
Cocoanuts	[2] 48.8	7.2	2.9	25.9	14.3	.9	1,413
Cocoanut, prepared	.....	3.5	6.3	57.4	31.5	1.3	3,125
Filberts	52.1	1.8	7.5	31.3	6.2	1.1	1,575
Hickory nuts	62.2	1.4	5.8	25.5	4.3	.8	1,265
Pecans, polished	53.2	1.4	5.2	33.3	6.2	.7	1,620
Peanuts	24.5	6.9	19.5	29.1	18.5	1.5	1,935
Piñon (*Pinus edulis*)	40.6	2.0	8.7	36.8	10.2	1.7	1,905
Walnuts, California, black	74.1	.6	7.2	14.6	3.0	.5	805
Walnuts, California, soft-shell	58.1	1.0	6.9	26.6	6.8	.6	1,375
Raisins	10.0	13.1	2.3	3.0	68.5	3.1	1,455
Miscellaneous:							
Chocolate	.....	5.9	12.9	48.7	30.3	2.2	2,860
Cocoa, powdered	.....	4.6	21.6	28.9	37.7	7.2	2,320
Cereal coffee, infusion (1 part boiled in 20 parts water)[3]	.....	98.2	.2	.....	1.4	.2	30

[1] Fruits contain a certain proportion of inedible materials, as skin, seeds, etc., which are properly classed as refuse. In some fruits, as oranges and prunes, the amount rejected in eating is practically the same as refuse. In others, as apples and pears, more or less of the edible material is ordinarily rejected with the skin and seeds and other inedible portions. The edible material which is thus thrown away, and should properly be classed with the waste, is here classed with the refuse. The figures for refuse here given represent, as nearly as can be ascertained, the quantities ordinarily rejected.

[2] Milk and shell.

[3] The average of five analyses of cereal coffee grain is: Water 6.2, protein 13.3, fat 3.4, carbohydrates 72.6, and ash 4.5 per cent. Only a portion of the nutrients, however, enter into the infusion. The average in the table represents the available nutrients in the beverage Infusions of genuine coffee and of tea like the above contain practically no nutrients.

PRODUCTS OF THE FISHERIES OF THE UNITED STATES: 1908.

Species.	Pounds.	Dollars.
Alewives	89,978,000	589,000
Black bass	3,313,000	255,000
Bluefish	7,647,000	506,000
Bream or Sunfish	4,738,000	120,000
Buffalo fish	16,729,000	498,000
Butterfish	6,855,000	237,000
Carp, German	42,763,000	1,135,000
Catfish	17,817,000	785,000
Cod	109,453,000	2,903,000
Croaker	8,143,000	226,000
Cusk	6,344,000	105,000
Drum, fresh-water	6,532,000	154,000
Drum, salt-water	4,576,000	164,000
Eels	3,358,000	203,000
Flounders	23,346,000	588,000
Haddock	59,987,000	1,308,000
Hake	34,340,000	464,000
Halibut	34,441,000	1,562,000
Herring	125,050,000	796,000
Herring (lake)	41,118,000	989,000
Mackerel	12,103,000	848,000
Menhaden	394,776,000	893,000
Mullet	33,703,000	908,000
Perch, white	2,412,000	137,000
Perch, yellow	7,898,000	258,000
Pike and Pickerel	2,959,000	174,000
Pike perch	15,247,000	580,000
Pollock	29,462,000	402,000
Pompano	570,000	71,000
Rockfish	2,454,000	66,000
Salmon	90,417,000	3,347,000
Scup	8,414,000	290,000
Sea bass	6,352,000	284,000
Shad	27,641,000	2,113,000
Smelt	4,340,000	174,000
Snapper, red	13,498,000	636,000
Spanish mackerel	3,806,000	194,000
Squeteague	49,869,000	1,776,000
Striped bass	3,657,000	314,000
Sturgeon	2,072,000	157,000
Suckers	8,555,000	215,000
Swordfish	2,714,000	198,000
Trout	12,024,000	800,000
Whitefish	7,722,000	524,000
Lobsters	15,279,000	1,931,000
Shrimp	14,374,000	390,000
Clams, hard	7,805,000	1,317,000
Clams, soft	8,654,000	553,000
Oysters	233,309,000	15,713,000
Mussel shells	81,869,000	392,000
Pearls and slugs	.....	300,000
Terrapin	268,000	80,000
Turtles	1,088,000	40,000
Sponges	622,000	545,000
Alligator hides	372,000	61,000
Mink skins	22,000	89,000
Muskrat skins	149,000	136,000
Otter skins	7,600	30,000
Whalebone	63,000	215,000
Scallops	2,414,000	317,000
Oil, sperm	3,391,000	252,000
Oil, whale	573,000	30,000
Irish moss	772,000	26,000

The total quantity and value of the products of the fisheries of the United States including the items mentioned above and all other fish products was 1,893,454,000 pounds, valued at $54,031,000. No later figures are available at time of publication. In many cases there was an increase, in other cases a decrease.

FORESTS OF THE UNITED STATES.

ESTIMATED AREA OF EXISTING NATIONAL FORESTS JUNE 30, 1911.

[Revised to conform to recent surveys and computations.]

	Acres.		Acres.
Alaska	26,748,850	Nevada	5,650,347
Arizona	14,898,000	New Mexico	11,111,300
Arkansas	2,225,890	North Dakota	13,920
California	27,735,455	Oklahoma	61,640
Colorado	14,761,900	Oregon	16,148,900
Florida	674,970	Porto Rico	65,950
Idaho	19,643,355	South Dakota	1,287,700
Kansas	303,937	Utah	7,667,585
Michigan	163,771	Washington	11,684,680
Minnesota	1,204,750	Wyoming	8,693,543
Montana	19,305,100		
Nebraska	556,700	Total area	190,608,243

	Acres.
Area embraced in additions to national forests during year	2,806,267
Area embraced in eliminations from national forests during year	4,598,705
Area embraced in temporary forest withdrawals June 30, 1911	3,319,495
Area embraced in existing national forests June 30, 1910	192,931,197
Area embraced in existing national forests June 30, 1911	190,608,243
Area decreased during the fiscal year ended June 30, 1911, of which decrease there is 530,516 acres due to revision of areas to conform to recent surveys and computations	2,322,954

NATIONAL MONUMENTS.

States and names.	Date created.	Area.	States and names.	Date created.	Area.
Alaska:		*Acres.*	New Mexico:		*Acres.*
Sitka	Mar. 23, 1910	[1] 57.00	Chaco Canyon	Mar. 11, 1907	20,629.40
Arizona:			El Morro	Dec. 8, 1906	160.00
Grand Canyon [2]	Jan. 11, 1908	[1] 806,400.00	Gila Cliff Dwellings [2]	Nov. 16, 1907	160.00
Montezuma Castle	Dec. 8, 1906	160.00	Gran Quivira	Nov. 1, 1909	[1] 160.00
Navajo	Mar. 20, 1909	[3] 600.00	Oregon:		
Tonto [2]	Dec. 19, 1907	[1] 640.00	Oregon Caves [2]	July 12, 1909	[1] 480.00
Tumacacori	Sept. 15, 1908	10.00	South Dakota:		
Petrified Forest	July 31, 1911	[4] 25,625.60	Jewel Cave [2]	Feb. 7, 1908	[1] 1,280.00
California:			Utah:		
Cinder Cone [2]	May 6, 1907	[1] 5,120.00	Mukuntuweap	July 31, 1909	[1] 15,840.00
Lassen Peak [2]	do	[1] 1,280.00	Natural Bridges	Sept. 25, 1909	[4] 2,740.00
Muir Woods	Jan. 9, 1908	295.00	Rainbow Bridge	May 30, 1910	160.00
Pinnacles	Jan. 16, 1908	[1] 2,080.00	Washington:		
Devil Postpile [2]	July 6, 1911	[1] 800.00	Mount Olympus [2]	Mar. 2, 1909	[1] 608,640.00
Colorado:			Wyoming:		
Wheeler [2]	Dec. 17, 1908	300.00	Devils Tower	Sept. 24, 1906	1,152.91
Colorado	May 24, 1911	13,883.06	Shoshone Cavern	Sept. 21, 1909	210.00
Montana:					
Big Hole	June 23, 1910	[1] 5.00	Total		[1] 1,509,027.97
Lewis and Clark Cavern	May 16, 1911	[4] 160.00			

[1] Estimated area.
[2] Under jurisdiction of Department of Agriculture.
[3] Based on 15 known ruins; within Indian reservation.
[4] According to second proclamation.

LUMBER AND TIMBER PRODUCTS STATISTICS.

In 1909 there were in the United States 40,671 establishments; 784,989 persons engaged in the industry, of which number, 48,825 were proprietors and firm members, 19,840 were salaried officers, superintendents and managers; 18,088 were male, and 3,717 female clerks. The average number of wage earners was 695,019: the number in the maximum month, November, was 739,160, and in the minimum month, January, 649,239. The total number of wage earners on December 15, 1909, or the nearest representative day, was 838,160, of which number, 826,978 were males, and 4,027 females, all being 16 years of age and over; while 6,886 males, and 269 females, were under 16. The capital invested was $1,176,675,407. The total expenses were $995,622,839, of which the officials received $22,448,332, clerks $17,979,364, wage earners $318,739,207, fuel and rent of power $3,082,287, other materials $503,035,292, rent of factory or works $2,623,146, taxes including internal revenue $9,863,384, contract work $32,491,242, and other miscellaneous work $76,360,585. The primary horse-power was 2,840,082. The value of products $1,156,128,747. The value added by manufacture, which is the difference between cost of materials and value of products, was $648,011,168.

LUMBER AND TIMBER PRODUCTS.

The total value of the lumber and timber products of the United States, in 1909, was $724,705,760. The total quantity of lumber made was 44,509,761 M. feet, board measure, valued at $684,479,859: Of this amount the softwoods comprised 33,896,959 M. feet, board measure, valued at $477,345,046. They were subdivided as follow:

16,277,185	M. ft. yellow pine, valued at	$206,505,297
1,499,985	" " western " " "	23,077,854
3,900,034	" " white " " "	70,830,131
4,856,378	" " Douglas fir " "	60,435,793
3,051,399	" " hemlock " "	42,580,800
1,748,547	" " spruce " "	29,561,315
955,635	" " cypress " "	19,549,741
521,630	" " redwood " "	7,720,124
346,008	" " cedar " "	6,901,948
740,158	" " all other kinds " "	10,182,043

Of the total quantity of lumber, the output of hardwoods was 10,612,802 M. feet, board measure, valued at $207,134,813. They were divided as follows:

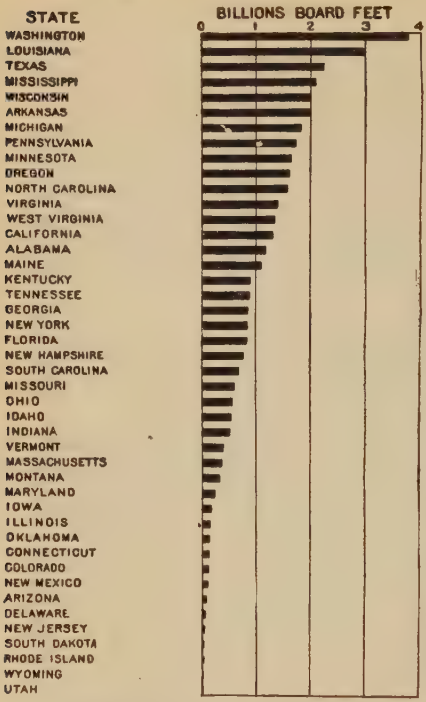
4,414,457	M. ft. oak, valued at	$90,512,069
1,106,604	" " maple, valued at	17,447,814
706,945	" " red gum, valued at	9,334,268
663,891	" " chestnut, " "	10,703,130
452,370	" " birch, " "	7,666,186
399,151	" " basswood, " "	7,781,563
347,456	" " elm, " "	6,088,098
265,600	" " cottonwood, " "	4,794,424
291,209	" " ash, " "	7,116,089
333,929	" " hickory, " "	10,283,776
46,108	" " walnut, " "	1,972,835
56,511	" " sycamore, " "	834,612
1,528,571	" " all other kinds, valued at	32,599,949

SHINGLES.

During the year 1910 there were 12,976,362 thousand shingles produced in the United States. They were cut from the following woods in the following quantities: Cedar 10,108,643 thousand; cypress 1,180,217; yellow pine 863,149; redwood 437,701; white pine 146,555; spruce 68,745; chestnut 52,091; hemlock 42,447; western pine 27,277; and of all other woods 49,537 thousand. Washington produced 64.2 per cent. of all the shingles used and Alabama, Arkansas, California, Florida, Georgia, Louisiana, Maine, Michigan, North Carolina, Oregon, Wisconsin and other states produced from one per cent. to three per cent. of the total production.

TIES: 1911.

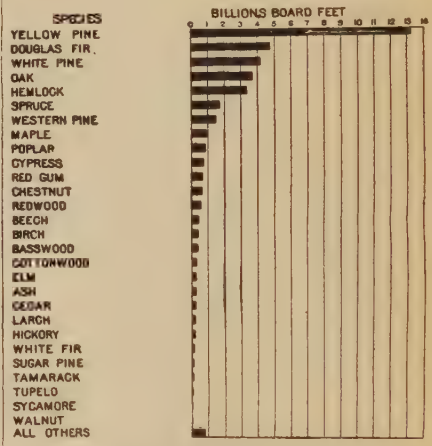
During the year 1911 there were 148,231,000 ties used by the railroads of the United States. Of this number 68,382,000 were oak; 26,264,000 southern pines; 7,305,000 cedar; 7,760,000 chestnut; 11,629,000 Douglas fir; 5,163,000 tamarack; 5,396,000 cypress; 3,468,000 hemlock; 4,612,000 western yellow pine; 2,165,000 redwood; 1,621,000 gum; and 4,466,000 of all other kinds. During the same period there were 3,870,694 poles purchased for electric wires of all kinds. They were of the following woods: Cedar 2,431,567; chestnut 677,517; oak 265,290; pine 184,677; cypress 75,459; and all other kinds 236,184.



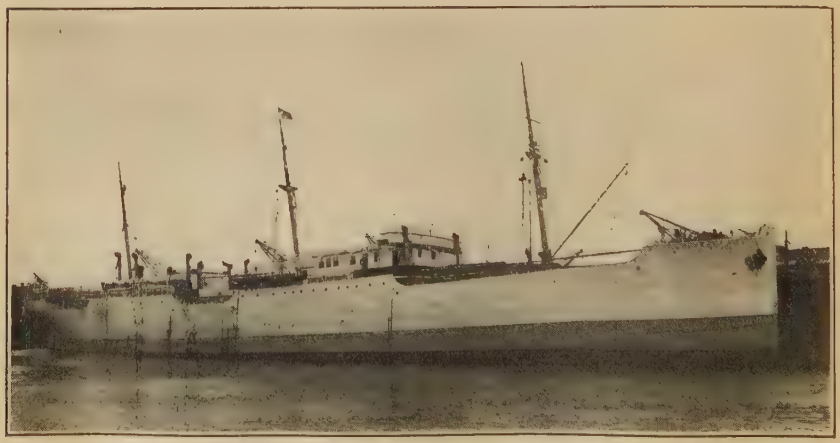
LUMBER CUTS BY STATES, 1907

Production of Turpentine and Resin: Quantity and Value, 1908–1910.

During the year 1910 there were 27,750,000 gallons of turpentine produced, having a total value of $17,680,000, against 36,589,000 gallons and a value of $14,112,400 in 1908. The total production of resin in 1910 was 3,404,000 barrels of 280 pounds and was valued at $18,255,000. For the year 1908 there were 4,288,283 barrels produced having a total value of $17,783,550.



RELATIVE CUTS FOR 1907.



THE COMING OF THE OIL DRIVEN STEAMER WILL CONSERVE BOTH FORESTS AND COAL FIELDS

Pulp Wood: 1911.

The total consumption of pulp wood in the United States in 1911 amounted to 4,328,052 cords, with 268 active mills. The kinds of wood consumed follows: Spruce, domestic, 1,612,355 cords; spruce, imported, 903,375 cords; hemlock, 616,663 cords; poplar, domestic and imported, 368,224 cords; balsam fir, 191,779 cords; pine, 124,019 cords; beech, 44,320 cords; slabwood, etc., 280,534 cords; all other, 186,783 cords.

The production of air-dry pulp in 1911 amounted to 2,686,134 tons, exceeding the output in 1910 by 152 158 tons, or 6 per cent. The method of manufacture was distributed as follows: Mechanical, 1,229,719 tons; sulphite, 1,126,496 tons; soda, 317,764 tons; sulphate, 12,155 tons.

PROBABLE FUTURE LAND CLASSIFICATION OF NORTH AMERICA.

Comparison of Log Rules for Board Measure.

SIXTEEN-FOOT LOGS.

	NAME OF RULE.	DIAMETER IN INCHES. 6	8	10	12	14	16	18
		BOARD FEET.						
1	Scribner[a]	18	32	54	79	114	159	213
2	Doyle	4	16	36	64	100	144	196
3	Doyle and Scribner	4	16	36	64	100	144	196
4	Holland or Maine	20	44	68	105	142	179	232
5	Humphrey or Vermont	24	43	66	96	130	170	217
6	Bangor	23	41	69	100	137	182	238
7	Cumberland River	.....	.....	47	68	93	121	153
8	Hanna	.....	32	51	80	117	160	213
9	Spaulding	.....	.....	50	77	114	161	216
10	Favorite	.....	.....	.....	64	98	142	197
11	Baxter	.....	34	56	84	117	156	200
12	Doyle and Baxter	.....	.....	36	64	100	144	196
13	Square of three-fourths	27	48	75	108	147	192	243
14	Square of two-thirds	.....	.....	58	85	114	150	192
15	Herring	.....	25	49	77	107	142	183
16	Dusenberry	.....	.....	42	68	100	136	170
17	Orange River	.....	.....	.....	76	104	136	173
18	Chapin	.....	.....	64	84	112	144	186
19	Northwestern	.....	33	61	77	117	170	206
20	Derby	28	49	75	110	148	195	248
21	Partridge	26	46	68	102	140	180	236
22	Parsons[b]	21	41	64	100	140	179	231
23	Ropp	.....	.....	.....	69	109	157	211
24	Stillwell	.....	.....	65	96	133	176	225
25	Baughman's rotary saw	17	41	70	105	145	193	244
26	Baughman's band saw	20	41	73	112	156	209	270
27	Saco River[b]	26	49	75	108	147	192	246
28	Ballon	22	40	61	79	117	170	206
29	Wilson	23	46	67	101	144	184	244
30	Wilcox	.....	.....	.....	66	101	144	180
31	Warner	.....	30	40	62	98	128	162
32	Boynton	.....	32	60	90	124	170	216
33	Forty-five	.....	38	61	90	125	168	218
34	White	.....	36	51	79	114	161	214
35	Finch and Apgar	.....	.....	.....	74	112	157	203
36	Constantine	.....	67	105	151	213	268	339
37	Ake	.....	41	65	95	128	167	212
38	Quebec	16	32	59	80	120	160	213
39	British Columbia	.....	.....	55	84	119	160	207
40	New Brunswick	.....	.....	.....	96	130	170	229
41	International	20	45	70	105	150	200	255
42	Champlain	22	43	70	105	146	193	247
43	Clement	18	37	62	94	131	175	226
44	Click	17	35	60	91	129	173	223

[a] Values for 6, 8, and 10 inches are those used by the Santa Clara Lumber Company, New York.

Comparison of Log Rules for Board Measure.

SIXTEEN-FOOT LOGS—Continued.

DIAMETER IN INCHES. 20	22	24	26	28	30	32	34	36	38	
BOARD FEET.										
280	334	404	509	582	657	736	800	923	1,068	1
256	324	400	484	576	676	784	900	1,024	1,156	2
256	324	400	484	582	657	736	800	923	1,068	3
302	363	439	507	614	706	795	900	1,026	1,135	4
267	320	384	.....	.....	.....	.....	.....	.....	.....	5
300	369	444	526	609	697	792	892	.....	.....	6
190	229	268	320	372	427	485	548	614	685	7
272	336	416	501	576	656	741	832	933	1,066	8
276	341	412	488	569	656	748	845	950	1,064	9
248	324	392	476	562	632	725	845	920	1,037	10
250	305	366	432	504	582	665	754	848	.....	11
256	305	366	432	504	582	665	754	848	.....	12
300	365	432	507	588	675	768	867	972	.....	13
236	285	341	400	464	533	605	684	768	854	14
230	284	344	411	485	567	655	752	857	963	15
229	285	346	414	487	567	652	744	841	945	16
213	258	308	360	418	480	546	616	692	769	17
233	294	374	465	563	666	777	896	1,027	1,161	18
248	324	392	450	536	632	725	845	920	1,037	19
307	368	438	512	593	680	773	872	977	.....	20
288	350	416	486	564	650	738	834	998	.....	21
300	366	433	506	600	705	.....	.....	.....	.....	22
272	339	413	493	579	672	771	877	989	1,107	23
261	320	385	456	533	588	675	768	.....	.....	24
310	382	457	540	633	722	822	934	1,054	1,142	25
340	417	500	590	686	790	900	1,022	1,182	1,286	26
302	366	436	513	590	674	771	.....	.....	.....	27
280	.....	.....	.....	.....	.....	.....	.....	.....	.....	28
306	374	448	529	616	713	814	922	.....	.....	29
240	313	373	446	513	592	673	754	853	973	30
203	258	316	372	431	490	560	630	.....	.....	31
266	322	384	450	522	.....	.....	.....	.....	.....	32
275	341	415	498	590	691	803	925	1,058	.....	33
290	338	402	492	575	649	728	797	.....	.....	34
258	318	400	474	552	624	733	840	928	1,054	35
416	507	603	708	821	942	1,072	1,210	1,356	1,511	36
261	316	377	441	512	588	669	.....	.....	.....	37
280	347	420	507	580	673	760	867	947	1,040	38
261	320	386	457	535	619	708	804	906	1,015	39
300	362	432	.....	.....	.....	.....	.....	.....	.....	40
320	390	470	555	645	745	850	965	1,085	1,210	41
308	376	450	532	620	714	814	923	1,038	1,159	42
282	345	414	490	571	659	753	854	961	1,074	43
280	343	413	489	571	660	755	857	965	1,079	44

[b] Values read off from a scaler's stick.

Comparison of Log Rules for Board Measure—Continued

SIXTEEN-FOOT LOGS—Continued.

	NAME OF RULE.	DIAMETER IN INCHES.			
		40	42	44	46
		BOARD FEET.			
1	Scribner	1,204	1,343	1,480	
2	Doyle	1,296	1,444	1,600	1,764
3	Doyle and Scribner	1,204	1,343	1,480	
4	Holland or Maine	1,261	1,401	1,523	1,701
5	Humphrey or Vermont				
6	Bangor				
7	Cumberland River	759	835	918	1,003
8	Hanna	1,200	1,333	1,477	1,616
9	Spaulding	1,185	1,312	1,448	1,581
10	Favorite	1,160	1,266	1,402	1,546
11	Baxter				
12	Doyle and Baxter				
13	Square of three-fourths				
14	Square of two-thirds	946	1,045	1,146	1,253
15	Herring	1,067	1,176		
16	Dusenberry	1,054	1,170		
17	Orange River	853			
18	Chapin	1,296	1,437	1,577	1,721
19	Northwestern	1,160	1,266	1,402	1,546
20	Derby				
21	Partridge				
22	Parsons				
23	Ropp	1,232	1,363	1,501	1,645
24	Stillwell				
25	Baughman's rotary saw	1,294	1,430	1,577	1,732
26	Baughman's band saw	1,425	1,582	1,745	1,900
27	Saco River				
28	Ballon				
29	Wilson				
30	Wilcox	1,120			
31	Warner				
32	Boynton				
33	Forty-five				
34	White				
35	Finch and Apgar	1,181	1,280	1,410	1,584
36	Constantine	1,671	1,846	2,026	2,215
37	Ake				
38	Quebec	1,173	1,267		
39	British Columbia	1,129	1,249	1,376	1,508
40	New Brunswick				
41	International	1,345	1,490	1,635	1,790
42	Champlain	1,287	1,422	1,564	1,711
43	Clement	1,193	1,319	1,451	1,589
44	Click	1,200	1,327	1,461	1,601

Comparison of Log Rules for Board Measure

SIXTEEN-FOOT LOGS—Continued.

	DIAMETER IN INCHES.						
	48	50	52	54	56	58	60
	BOARD FEET.						
1							
2	1,936	2,116	2,304	2,500	2,704	2,916	3,136
3							
4	1,848						
5							
6							
7	1,092	1,172	1,281	1,382	1,486	1,594	1,707
8	1,765	1,930					
9	1,724	1,872	2,025	2,184	2,350	2,524	2,704
10	1,696						
11							
12							
13							
14	1,365	1,481					
15							
16							
17							
18	1,865	2,016	2,160	2,313	2,467	2,627	2,791
19	1,696						
20							
21							
22							
23	1,795	1,952	2,115	2,285	2,461	2,643	2,832
24							
25	1,884	2,041	2,206	2,396	2,590	2,764	2,898
26	2,089	2,270	2,449	2,636	2,841	3,073	3,265
27							
28							
29							
30							
31							
32							
33							
34							
35							
36	2,425	2,617					
37							
38							
39	1,647	1,791	1,942	2,099	2,262	2,431	2,606
40							
41	1,955	2,125	2,300	2,485	2,675	2,870	3,075
42	1,866	2,028	2,196	2,371	2,553	2,741	2,936
43	1,734	1,884	2,042	2,205	2,375	2,550	2,733
44	1,747	1,900	2,059				

Contents of 1-inch Boards of Different Lengths and Widths Given in Board Feet and Twelfths.

Length.	WIDTH OF BOARD (INCHES).																					
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	CONTENTS (BOARD FEET).																					
Feet.																						
4	1	1^{4}	1^{8}	2	2^{4}	2^{8}	3	3^{4}	3^{8}	4	4^{4}	4^{8}	5	5^{4}	5^{8}	6	6^{4}	6^{8}	7	7^{4}	7^{8}	8
5	1^{8}	1^{8}	2^{1}	2^{6}	2^{11}	3^{4}	3^{9}	4^{2}	4^{7}	5	5^{5}	5^{10}	6^{3}	6^{8}	7^{1}	7^{6}	7^{11}	8^{4}	8^{9}	9^{2}	9^{7}	10
6	1^{6}	2	2^{6}	3	3^{6}	4	4^{6}	5	5^{6}	6	6^{6}	7	7^{6}	8	8^{6}	9	9^{6}	10	10^{6}	11	11^{6}	12
7	1^{9}	2^{4}	2^{11}	3^{6}	4^{1}	4^{8}	5^{3}	5^{10}	6^{5}	7	77	8^{2}	8^{9}	9^{4}	9^{11}	10^{6}	11^{1}	11^{8}	12^{3}	12^{10}	13^{5}	14
8	2	2^{8}	3^{4}	4	4^{8}	5^{4}	6	6^{8}	7^{4}	8	8^{8}	9^{4}	10	10^{8}	11^{4}	12	12^{8}	13^{4}	14	14^{8}	15^{4}	16
9	2^{3}	3	3^{9}	4^{6}	5^{3}	6	6^{9}	7^{6}	8^{3}	9	99	10^{6}	11^{3}	12	12^{9}	13^{6}	14^{3}	15	15^{9}	16^{6}	17^{3}	18
10	2^{6}	3^{4}	4^{2}	5	5^{10}	6^{8}	7^{6}	8^{4}	9^{2}	10	10^{10}	11^{8}	12^{6}	13^{4}	14^{2}	15	15^{10}	16^{8}	17^{6}	18^{4}	19^{2}	20
11	2^{9}	3^{8}	4^{7}	5^{6}	6^{5}	7^{4}	8^{3}	9^{2}	10^{1}	11	11^{11}	12^{10}	13^{9}	14^{8}	15^{7}	16^{6}	17^{5}	18^{4}	19^{3}	20^{2}	21^{1}	22
12	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
13	3^{3}	4^{4}	5^{5}	6^{6}	7^{7}	8^{8}	9^{9}	10^{10}	11^{11}	13	14^{1}	15^{2}	16^{3}	17^{4}	18^{5}	19^{6}	20^{7}	21^{8}	22^{9}	23^{10}	24^{11}	26
14	3^{6}	4^{8}	5^{10}	7	8^{2}	9^{4}	10^{6}	11^{8}	12^{10}	14	15^{2}	16^{4}	17^{6}	18^{8}	19^{10}	21	22^{2}	23^{4}	24^{6}	25^{8}	26^{10}	28
15	3^{9}	5	6^{3}	7^{6}	8^{9}	10	11^{3}	12^{6}	13^{9}	15	16^{3}	17^{6}	18^{9}	20	21^{3}	22^{6}	23^{9}	25	26^{3}	27^{6}	28^{9}	30
16	4	5^{4}	6^{8}	8	9^{4}	10^{8}	12	13^{4}	14^{8}	16	17^{4}	18^{8}	20	21^{4}	22^{8}	24	25^{4}	26^{8}	28	29^{4}	30^{8}	32
18	4^{6}	6	7^{6}	9	10^{6}	12	13^{6}	15	16^{6}	18	19^{6}	21	22^{6}	24	25^{6}	27	28^{6}	30	31^{6}	33	34^{6}	36
20	5	6^{8}	8^{4}	10	11^{8}	13^{4}	15	16^{8}	18^{4}	20	21^{8}	23^{4}	25	26^{8}	28^{4}	30	31^{8}	33^{4}	35	36^{8}	38^{4}	40
22	5^{6}	7^{4}	9^{2}	11	12^{10}	14^{8}	16^{6}	18^{4}	20^{2}	22	23^{10}	25^{8}	27^{6}	29^{4}	31^{2}	33	34^{10}	36^{8}	38^{6}	40^{4}	42^{2}	44
24	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
26	6^{6}	8^{8}	10^{10}	13	15^{2}	17^{4}	19^{6}	21^{8}	23^{10}	26	28^{2}	30^{4}	32^{6}	34^{8}	36^{10}	39	41^{2}	43^{4}	45^{6}	47^{8}	49^{10}	52
28	7	9^{4}	11^{8}	14	16^{4}	18^{8}	21	23^{4}	25^{8}	28	30^{4}	32^{8}	35	37^{4}	39^{8}	42	44^{4}	46^{8}	49	51^{4}	53^{8}	56
30	7^{6}	10	12^{6}	15	17^{6}	20	22^{6}	25	27^{6}	30	32^{6}	35	37^{6}	40	42^{6}	45	47^{6}	50	52^{6}	55	57^{6}	60
32	8	10^{8}	13^{4}	16	18^{8}	21^{4}	24	26^{8}	29^{4}	32	34^{8}	37^{4}	40	42^{8}	45^{4}	48	50^{8}	53^{4}	56	58^{8}	61^{4}	64

NATIONAL CONSERVATION ASSOCIATION.

The National Conservation Association, with headquarters in the Colorado Building, Washington, D. C., is the organized head of the conservation movement in the United States. The association came into existence because of an urgent need for an organization open to every man and woman who stood for conservation, and which would give them an immediate opportunity for united and effective work.

The first step was taken on July 29, 1909. A group of men who had led in the fight for conservation met and organized the National Conservation Association. Dr. Charles W. Eliot, president emeritus of Harvard University, was made president. Soon afterward Dr. Eliot was made honorary president of the Association, and Mr. Gifford Pinchot became president.

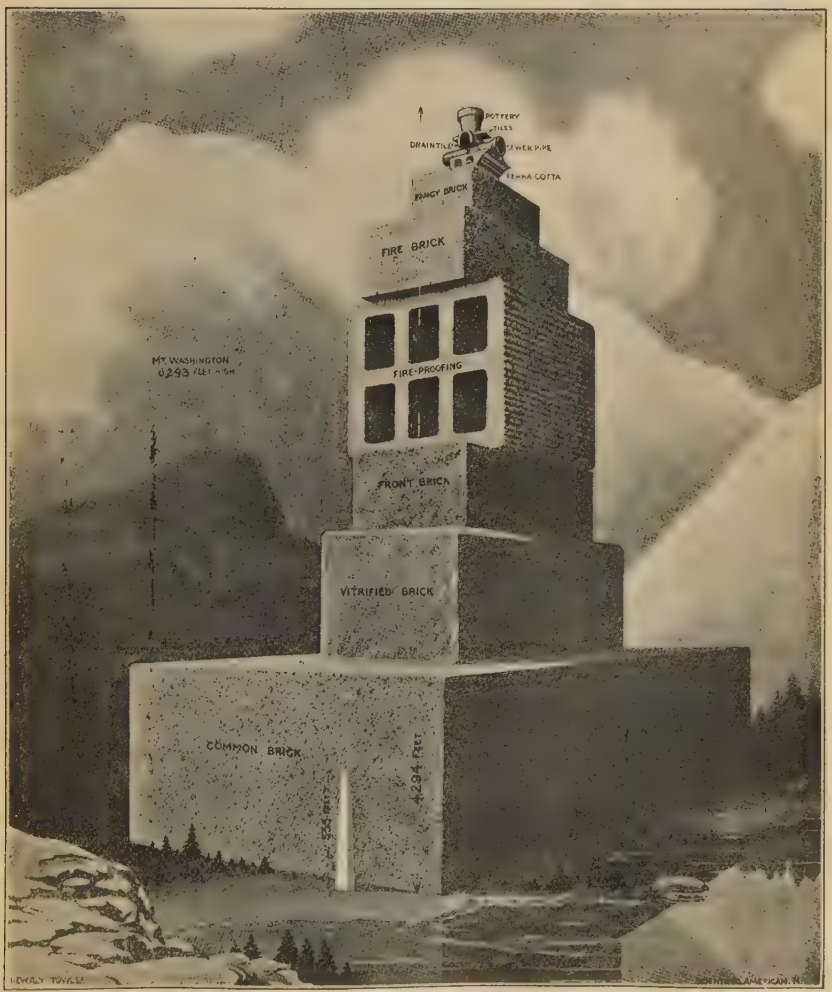
In reply to a request for a statement as to the objects of the Association the following is made:

"The National Conservation Association is fighting for the prompt and orderly development of our natural resources, for the welfare of ourselves and our children, and for the rights of the plain people. The Association is bound neither by political considerations nor official connections. It is free to speak the whole truth.

"That conservation means the use of our natural resources for the benefit of us all and not merely for the profit of a few is already household knowledge. The task which the National Conservation Association has set itself is to get this principle put into practical effect."

CHAPTER III.

MINES AND QUARRIES.



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CLAY PRODUCTS OF THE UNITED STATES, 1907.

A pyramid of burned clay would be 4,294 feet high and represents a value of $158,942,369.

SUBDIVISIONS OF GEOLOGIC TIME AND STRATA.

(Prepared Expressly for the American Almanac by Professor Willard C. Hayes, of the United States Geological Survey.)

The rocks forming the earth's crest are divided into three classes: (a) Sedimentary, including all rocks formed by aqueous, organic, glacial and eolian agencies; (b) Igneous, including all rocks that have been solidified from a molten condition, both volcanic and plutonic; (c) Metamorphic, including altered rocks of either sedimentary or igneous origin, in which the acquired are more prominent than the original characteristics, together with the ancient crystalline schists of uncertain origin.

The sedimentary rocks are subdivided into formations, which are groups of strata of similar composition or containing the same fossils. The formations are grouped into larger aggregates called systems, which correspond to divisions of the time scale called periods. The systems and their corresponding periods are of world-wide occurrence, and standard terms are employed throughout the world. Formations, however, are local, and cannot generally be identified in more than a single geologic province. The following standard column is applicable only to the United States. It represents the most recent usage as adopted by the United States Geological Survey.

Subdivisions of Geologic Time.	Subdivisions of Rock Strata.		
Eras.	Systems.	Series.	Groups and Formations.
			South Atlantic and Gulf Coastal Plain.
Age of man	Quaternary	Recent Pleistocene	Columbia loam and gravel.
Cenozoic		Pliocene	Lafayette gravel. Shell Creek limestone. Caloosahatchee limestone.
		Miocene	Chesapeake sands.
Age of mammals	Tertiary	Oligocene	Oak Grove beds. Chipola group. Chattahoochee beds. Vicksburg limestone.
		Eocene	Jackson clays. Claiborn limestone. Hatchetigbee clays. Midway limestone.
			Texas Great Plains Region.
	Cretaceous	Upper Cretaceous	Montana sandstone. Colorado shales. Dakota sandstone.
		Comanche	Washita group. Fredericksburg group. Trinity sands.
Mesozoic Age of reptiles			**North Atlantic Coastal Plain.**
	Jurassic	Lower Potomac	Arundel sands. Patuxent clays.
	Triassic	Newark	Brunswick sandstone. Lackatong shale. Stockton sandstone and shale.
			New York-Pennsylvania Region.
	Carboniferous	Permian	Dunkard sandstone.
Age of acrogens		Pennsylvanian	Monongehelasandstone and shale. Conemaugh sandstone and shale. Allegheny sandstone and shale. Pottsville—conglomerate.
		Mississippian	Manch Chunk shale. Pocono sandstone.
	Devonian	Neodevonian	Chemung sandstone. Portage sandstone.
Age of fishes		Mesodevonian	Hamilton shale. Marcellus limestone.
		Eodevonian	Corniferous limestone. Schoharie grits. Oreskony sandstone.
	Silurian	Ontarian	Lower Heldenberg limestone. Salina sandstone. Niagara limestone. Clinton sandstone. Medina sandstone.
Palezoic		Champlanian	Hudson slate. Utica shale. Trenton limestone. Chozy limestone. Calciferous limestone.
Age of invertebrates	Cambrian	Potsdamian	Potsdam sandstone.
		Acadian	Acadia limestone.
		Georgian	Georgia slate.
			Lake Superior Region.
	Algonkian	Keweenawan	Keweenaw slate.
		Upper Huronian	Hanbury slate. Vulcan slate.
		Lower Huronian	Negaunee formation. Randville dolomite. Sturgeon quartzite.
Azoic	Archeon	Laurentian	

MINERAL PRODUCTS OF THE UNITED STATES.

Product.	1910. Quantity.	Value.
METALS.		
Pig iron (spot value) ..... long tons..	27,303,567	$425,115,235
Silver, commercial value ..... troy ounces..	57,137,900	30,854,500
Gold, coining value ..... do..	4,657,018	96,269,100
Copper, value at New York City ..... pounds..	1,080,159,509	137,180,257
Lead, value at New York City ..... short tons..	372,227	32,755,976
Zinc, value at St. Louis ..... do....	252,479	27,267,732
Quicksilver, value at San Francisco ..... flasks..	20,601	958,153
Aluminum ..... pounds..	47,734,000	8,955,700
Antimonial lead ..... short tons..	14,069	1,338,090
Tin ..... pounds..	.....	23,447
Platinum, value at New York City ..... troy ounces..	773	25,277
Total value of metals	.....	760,743,467
NONMETALS (SPOT VALUE).		
Bituminous coal ..... short tons..	417,111,142	469,281,719
Pennsylvania anthracite ..... long tons..	75,433,246	160,275,302
Natural gas	.....	70,756,158
Petroleum ..... barrels..	209,556,048	127,896,328
Peat	.....	140,209
Clay products	.....	170,115,974
Cement ..... barrels..	77,785,141	68,752,092
Lime ..... short tons..	3,481,780	13,894,962
Sand (molding, building, etc.) and gravel ..... do....	66,949,347	19,520,919
Sand-lime brick	.....	1,169,153
Slate	.....	6,236,759
Stone	.....	76,520,584
Corundum and emery ..... short tons..	1,028	15,077
Garnet for abrasive purposes ..... do....	3,814	113,574
Grindstones	.....	796,294
Infusorial earth and tripoli ..... short tons..	.....	130,006
Millstones	.....	28,217
Oilstones, etc	.....	228,694
Pumice ..... short tons..	23,271	94,943
Arsenious oxide ..... pounds..	2,994,000	52,305
Borax (crude) ..... short tons..	42,357	1,201,842
Bromine ..... pounds..	245,437	41,684
Fluorspar ..... short tons..	69,427	430,196
Gypsum ..... do....	2,379,057	6,523,029
Lithium minerals ..... do....	.....	(a)
Phosphate rock ..... long tons..	2,654,988	10,917,000
Pyrite ..... do....	238,154	958,608
Sulphur ..... do....	255,534	4,605,112
Salt ..... barrels..	30,305,656	7,900,344
Barytes (crude) ..... short tons..	42,975	121,746
Mineral paints ..... do....	85,685	2,174,735
Zinc oxide ..... do....	59,333	5,325,636
Asbestos ..... do....	3,693	68,357
Asphalt ..... do....	260,080	3,080,067
Bauxite ..... long tons..	148,932	716,258
Chromic iron ore ..... do....	205	2,729
Feldspar ..... short tons..	81,102	502,452
Fuller's earth ..... do....	32,822	293,709
Gems and precious stones	.....	295,797
Glass sand ..... short tons..	1,461,089	1,516,711
Graphite (crystalline) ..... pounds..	5,590,592	295,733
Graphite (amorphous) ..... short tons..	35,945	81,443
Magnesite ..... do....	12,443	74,658
Manganese ore ..... long tons..	2,258	22,892
Manganiferous ore ..... do....	61,101	186,765
Mica (sheet) ..... pounds..	2,476,190	283,832
Mica (scrap) ..... short tons..	4,065	53,265
Mineral waters ..... gallons sold..	62,030,125	6,357,590
Quartz ..... short tons..	63,577	193,757
Talc and soapstone ..... do....	79,006	864,213
Talc, fibrous ..... do....	71,710	728,180
Thorium minerals (monazite) and zircon ..... pounds..	99,301	12,006
Titanium ore (rutile) ..... do..	566	44,480
Tungsten ore ..... short tons..	1,821	807,307
Uranium and vanadium minerals ..... do....	.....	(a)
Total value of nonmetals	.....	1,242,701,402
Total value of metals	.....	760,743,467
Estimated value of mineral products unspecified	.....	300,000
Grand total	.....	2,003,744,869

a Included under unspecified.

VALUE OF IMPORTS FOR CONSUMPTION AND OF EXPORTS OF MINERAL PRODUCTS IN THE CALENDAR YEAR 1910.

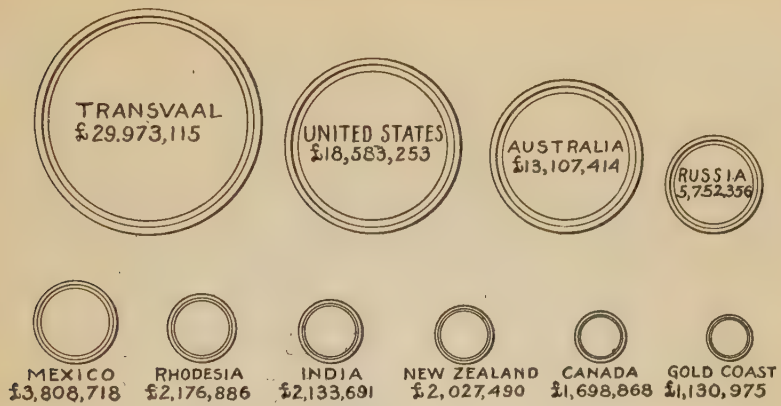
The imports of mineral products into the United States may be divided into metals and non-metals, the imports of the former amounting in 1910 to $104,994,227 and of the latter to $119,635,764, a total of $224,629,991 worth of mineral products imported into the United States in 1910. The imports of metals during the year were as follows: Aluminum salts, $53,671; antimony (metal, regulus, and ore), $539,755; antimony salts, $14,201; bauxite, $65,743; bismuth, $332,668; cadmium, $2,295; chromic iron ore, $415,768; chromium salts, $21,204; cobalt (oxide, ore and zaffer), $6,352; copper, in ore, matte, ingots, bars, manufactures, etc., $40,849,239; iron ore, $7,832,225; lead in ore, base, bullion, pigs, sheets, manufactures, etc., $755,092; manganese ore, $1,711,131; molybdenum, $14,402; nickel, in ore, matte, oxide, etc., $4,227,838; platinum, $3,654,664; quicksilver, $381; tin, $33,913,255; titanium alloy, $767; tungsten ore, $344,979; type metal, $485,493; uranium salts and oxide, $10,176; zinc, in ore, pigs, sheets, dust, manufactures, etc., $1,027,941; iridium, osmium, palladium, and rhodium, $180,805. The imports of non-metals for the same period may be divided in similar fashion into: Alizarin, $430,393; aniline salts, $501,369; arsenic sulphides, etc., $314,306; asbestos, $1,543,249; asphalt, $785,963; barytes, $78,239; barium compounds, $470,449; borax, $12,397; burrstones and millstones, $34,763; cement, hydraulic, $395,526; clay, $320,891; clay products, brick and tile, etc., $206,613, and pottery, etc., $11,127,405; coal, anthracite, $42,244 and bituminous, $3,975,561; coal-tar products, $7,423,815; coke, $625,130; corundum and emery, $816,167; cryolite, $2,343; fertilizers, $8,351,697 and phosphates, crude, $235,040 and guano, $667,870; flint and flint pebbles, $307,286; fluorspar, $135,152; Fuller's earth, $132,545; gems and precious stones, $40,704,-487; granite, $176,912; graphite, $1,872,592; grindstones, $106,596; gypsum, $502,111; hones, oilstones, whetstones, $45,819; infusorial earth and rotten stone, $116,057; kaolin or china clay, $1,593,472; lead paints—litharge, orange mineral, red lead, white lead, $106,118; lime, $63,791; magnesite and magnesia, $1,578,683; marble and stone, $1,392,231; mica, $724,525; mineral waters, $983,136; monaxite and thorium oxide, $16,824; ocher, $131,846; peat, $41,938; petroleum, $136,292; ozokerite and paraffin, $1,025,701; potassium salts, $7,986,480; pumice, $104,425; pyrite, $2,748,647; salt, $370,922; sand and gravel, $133,757; sienna and umber, $76,872; slate, $4,127; sodium nitrate, $16,652,117; strontium oxide, $23; sulphur, $558,611; talc, $106,460; thorium nitrate, $219,615; venetian red, $21,591; zinc oxide, $396,573.

The exports of mineral products from the United States again may be divided into metals and non-metals, the exports of the former amounting to $109,034,851, and of the latter to $164,503,755, or a total of $273,538,606 worth of mineral products exported from the United States during the year 1910. The exports of metals for the year were as follows: Aluminum and manufactures, etc., $949,215; copper, in ore, matte, ingots, bars, manufactures, etc., $96,554,432; iron ore, $2,074,164; pig iron (including scrap), $2,489,446; lead, in ore, base bullion, pigs, sheets, manufactures, etc., $614,158; nickel, in ore, matte, oxide, etc., $4,704,088; quicksilver, $91,077; zinc, in ore, pigs, sheets, dust, manufactures, etc., $1,558,271. The exports of non-metallic products were as follows: Asphalt, $702,520; cement, hydraulic, $3,477,981; clay products, brick and tile, etc., $1,602,913 and pottery, etc., $1,041,689; coal, anthracite, $14,785,387, and bituminous, $26,685,405; coke, $3,053,293; fertilizers, phosphates, crude, $8,234,276; lime, $127,-952; marble and stone, $1,538,339; petroleum, $94,107,022; paraffin and paraffin wax, $7,329,143; salt, $320,926; sulphur, $552,941; zinc oxide, $943, 968.

CALENDAR OF EVENTS AND DISCOVERIES RELATIVE TO THE PRECIOUS METALS.

1530-1540. Pillage of Peru.
1547-1548. Discovery of Guanajuato silver mines in Mexico.
1577. Discovery of gold in Brazil.
1670. Discovery of placers of Garazua.
1680. Discovery of placers of Minas-Geraes.
1704-1728. Silver mines opened in Russia.
1743. Discovery of gold in the Ural.
1848. Discovery of Placers in California.
1848. Introduction of Plattner's chlorination process at Reichenstein in Silesia.
1851. Discovery of placers in Australia.
1853. Introduction of hydraulic mining in California.
1853. Maximum annual production of gold in California, amounting to $65,000,000 for the year.
1858. Introduction of chlorination process at Grass Valley, California.
1866. Invention of dynamite.
1886. Opening of the "banket" reef of the Rand, South Africa.
1889. Development of Manké's method of bessemerizing copper mattes and the successful refining of this impure copper by electricity.
1890. Introduction of the cyanide process in the Rand, South Africa.
1897. Discovery of placers in the Yukon.

The price per unit of the production (gold excepted, which is fixed by law) is based upon the average for the year 1910 of daily New York prices for the metals, as follows: Gold per fine ounce, $20.6718346255323; silver per fine ounce, $0.54; copper per pound, $0.127; lead per pound, $0.044; and zinc per pound, $0.054.



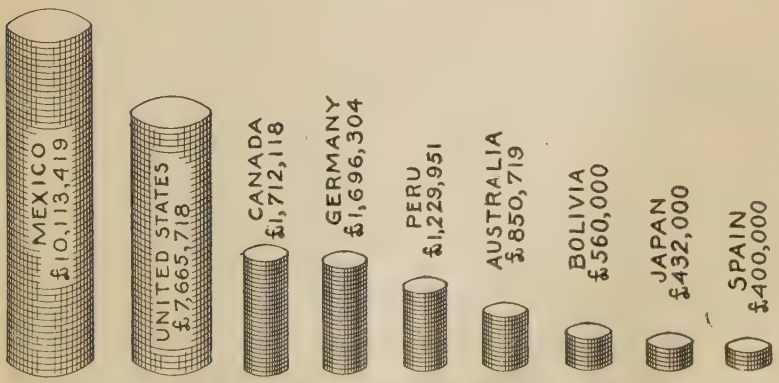
A YEAR'S PRODUCTION OF GOLD
(in pounds sterling)

Gold and Silver.

During the year 1880 there were 1,741,500 fine ounces of gold produced with a value of $36,000,000 and 30,318,700 fine ounces of silver, having a value of $34,717,000. In 1890 the 1,588,877 ounces of gold were valued at $32,845,000 and the 54,516,300 fine ounces of silver $57,242,000. For the year 1900 the 3,829,897 ounces of fine gold produced had a value of $79,171,000 and the 57,647,000 ounces of silver a value of $35,741,000. During the year 1910 there were 4,657,018 fine ounces of gold produced with a total value of $96,269,100 and 57,137,900 fine ounces of silver with a value of $30,854,500.

Platinum.

In 1910 the production of refined platinum from domestic ore was 773 troy ounces, valued at $25,277, and from imported crude platinum and from imported matte and bullion was 4,800 ounces, valued at $156,960. The largest part of this is derived from crude platinum sand imported from Colombia and Russia. The total output of refined platinum in the United States from ores of domestic and foreign origin is then about 5,573 fine ounces, valued at $182,237. The total world's production of crude platinum is 286,952 troy ounces.



A YEAR'S PRODUCTION OF SILVER
(in pounds sterling)

Lead.

The production of lead in 1910 was 372,227 short tons, valued at $32,755,976, as compared with 354,188 tons, valued at $30,460,168 in 1909. The imports of lead were valued at $755,092 in 1910 against $861,506 in 1909. The exports were valued at $614,158 against $509,542 in 1900. The imports of type metal were valued at $485,493 in 1910 against $532,108 in 1909. The United States ranks first in the production and consumption of lead; with a production of 372,227 short tons; Spain ranks second with a production of 211,201 tons; Germany third with 174,053 tons; Mexico fourth with 138,890 tons; and Australia fifth with 108,907 tons.

Quicksilver.

The production of quicksilver in 1910 amounted to 20,601 flasks, valued at $958,153. California reported 17,211 flasks in 1910; Texas, 3,320 flasks; Nevada, 70 flasks. The imports were valued at $381 in 1910, and the exports at $91,077.

Iron.

The production of iron ore in 1910 amounted to 56,889,734 long tons, valued at the mines at $140,735,607, as compared with 51,155,437 long tons, valued at $109,964,903, in 1909, and with 41,113,116 long tons, valued at $86,511,485, the average yearly production for the five years, 1904 to 1908, inclusive. This total production of 56,889,734 long tons, for the year 1910, consisted of the following ores: Hematite, 51,367,007 long tons; Brown ore, 2,868,572 long tons; Magnetite, 2,631,835 long tons; and Carbonate, 22,320 long tons. The rank of the principal iron-ore producing States with regard to both the quantity and the percentage of the total production follows: Minnesota, 31,966,769 long tons; or 56.19%; Michigan, 13,303,906 long tons, or 23.39%; Alabama, 4,801,275 long tons, or 8.44%; New York, 1,287,209 long tons, or 2.26%; Wisconsin, 1,149,551 long tons, or 2.02%; Virginia, 903,377 long tons, or 1.59%; California, Colorado, New Mexico, Washington and Wyoming, 861,850 long tons, or 1.52%; Pennsylvania, 739,799 long tons, or 1.30%; Tennessee, 732,247 long tons, or 1.29%. The principal iron-ore producing region is the Lake Superior region, which alone in 1910 produced 46,328,743 long tons. The Lake Superior district includes the Vermilion, Mesabi, Cuyuna, Penokee-Gogebic, Marquette, and Menominee ranges in the States of Minnesota, Michigan and Wisconsin. The production of these ranges for the year 1910 in long tons was for the Marquette range, 4,631,427 tons, for the Menominee 4,983,729 tons, for the Gogebic 4,746,818 tons, Vermilion 1,390,360 tons, and for the Mesabi 30,576,409 tons.

The apparent consumption of iron-ore for intervals of ten years was as follows: 1890, 16,302,025 long tons; 1900, 26,722,583 long tons; 1910, 56,161,091 long tons.

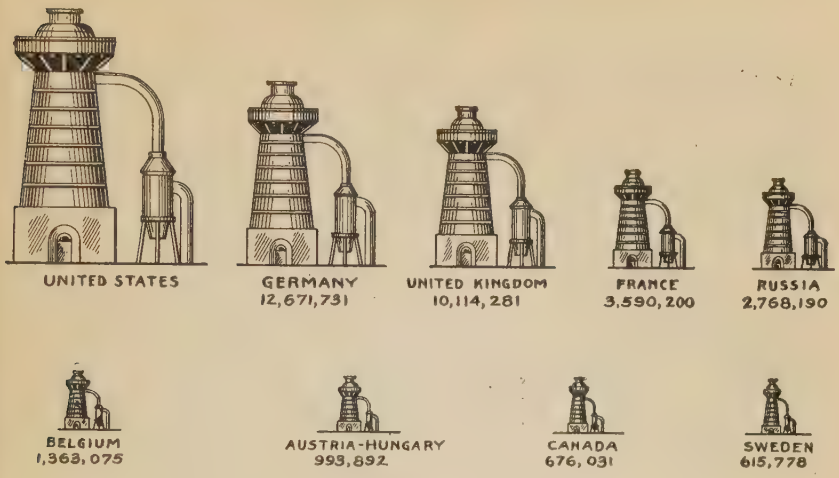
The imports of iron-ore in 1910 were valued at $7,832,225 against $4,579,078 in 1909, and against $2,458,542, the average annual value for the five years from 1904 to 1908. The exports in 1910 were valued at $2,074,164, as against $1,365,325 in 1909, $1,012,924 in 1908, and $763,422 in 1907. As in the 11 preceding years, the production of iron-ore in the United States in 1910 was never equaled by that of any other country.

Recent investigation by the House Steel Investigating Committee shows that in the Lake Superior region about 1,400,000,000 tons of iron ore are still available.

WORLD'S PRODUCTION OF IRON ORE IN 1908 AND 1909, BY COUNTRIES.

Country.	1908.	1909.
	Tons.	*Tons.*
United States	35,924,771	51,155,437
Germany and Luxemburg	24,278,151	25,506,000
United Kingdom	15,031,025	14,979,979
Spain	9,271,592	(a)
France	10,057,145	11,890,000
Russia	(a)	(a)
Sweden	4,713,160	(a)
Austria-Hungary	4,718,700	(b)
Canada	c 212,573	c 239,324
Newfoundland	935,154	c 991,115
Cuba	930,446	1,417,914
Algeria	943,424	891,000
Tunis	148,000	218,000
Greece	515,368	(a)
Italy	539,120	531,000
Belgium	188,780	200,000
China d	133,458	(a)
India	72,300	83,456
Japan	(a)	(a)
Norway	119,656	(a)
Australia	55,194	(a)

a Not available.
b Austria produced 2,490,000 tons. Figures for Hungary not available
c Shipments.
d Exports.



IRON.
A YEAR'S PRODUCTION
(in tons.)

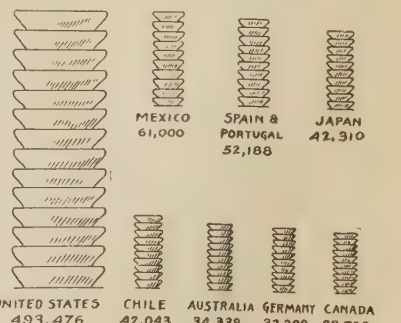
COPPER

The production of copper in 1910 was 1,080,159,509 pounds, valued at $137,180,257 as against 1,092,951,624 pounds, valued at $142,083,711, in 1909, and against 888,763,603 pounds, valued at $144,248,017, the average production for the five-year period ending 1908. The increase by decades in the production of copper is shown as follows: 1845, 224,000 pounds; 1855, 6,720,000 pounds; 1865, 19,040,000 pounds; 1875, 40,320,000 pounds; 1885, 165,875,766 pounds; 1895, 380,613,404 pounds; 1905, 901,907,843 pounds; 1910, 1,080,159,509 pounds. Considerable copper was reported by the mines, from ores mined primarily for other metals, and in all 264,680.08 fine ounces of gold and 16,024,424 fine ounces of silver were obtained from ores in which copper was the principal constituent.

Forms in which copper was cast in 1910 included wire bars, 720,505,724 pounds, or 50%; ingots and ingot bars, 441,302,990 pounds, or 31%; cakes, 142,660,100 pounds, or 10%; cathodes, 99,500,146 pounds, or 7%; other forms, 26,620,036 pounds, or 2%, giving the total of 1,430,588,996 pounds.

The imports in 1910 were valued at $40,849,239, as against $38,762,951, in 1909; $29,664,129 in 1908 and $46,912,347, in 1907. The exports in 1910 were valued at $96,554,432, as against $93,919,956, in 1909, $91,809,675, in 1908, and $103,252,917, in 1907.

The smelter production of copper in the world was 1,903,297,003 pounds in 1910 as compared with 1,873,404,407 pounds in 1909. In 1910 the smelter output of the United States was 56.75 per cent. of the world's production as compared with 58.22 per cent. in 1909 and with 56.54 per cent. in 1908. The following shows the principal copper producing countries of the world, for the year 1910. Germany, 55,335,460 pounds; Italy, 7,275,180 pounds; Norway, 23,368,760 pounds; Russia, 50,044,420 pounds; Spain and Portugal, 112,655,060 pounds; Hungary, 11,023,000 pounds; Canada, 56,598,074 pounds; Mexico, 131,614,620 pounds; United States, 1,080,159,509 pounds; Chile, 78,924,680 pounds; Peru, 41,005,560 pounds, and Japan, 102,954,820 pounds.

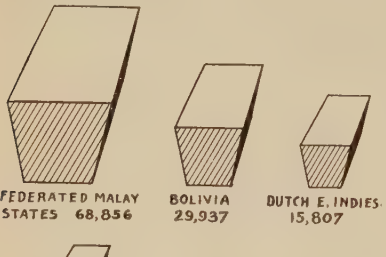


COPPER.
A YEAR'S PRODUCTION.
(in tons.)

The first illumination by gas in the United States was in the streets of Boston in 1823.

Tin.

In 1910 nominal outputs of tin as ore, concentrates and metal, were reported, valued at $203,447, and coming from Alaska, North Carolina, South Dakota and Texas. A small production of metallic tin was reported from South Dakota, in 1909, valued at $4,832. A few tons of stream tin were produced from Buck Creek, Alaska, and were shipped to Penzance, England—as to Hamburg, Germany, in 1908. The imports of tin in 1910 were valued at $33,913,255.



TIN.
A YEAR'S PRODUCTION.
(in tons.)

The Permanent Court of Arbitration.

This court, more popularly known as The Hague Tribunal, was constituted by virtue of the convention for the pacific regulation of international questions, concluded at The Hague, July 29, 1899. (Office, Prinsegracht 71, The Hague.)

Administrative Council.—President: The Minister for Foreign Affairs for Holland. Members: The diplomatic representatives of all the signatory powers accredited to The Hague.

Members of the Permanent Court of Arbitration.—Since the individuals themselves are constantly changing by ill health or death, we shall content ourselves by giving the signatory powers alone, letting it suffice to say that these powers appoint their most distinguished men, preferably lawyers, to the position. They are: Austria-Hungary, Belgium, Bulgaria, Denmark, France, Germany, Great Britain, Greece, Holland, Italy, Japan, Luxemburg, Mexico, Portugal, Roumania, Russia, Servia, Spain, Sweden, and Norway, Switzerland, and the United States.

Carnegie Peace Fund.

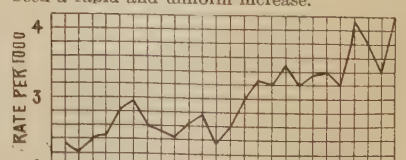
On December 14, 1910, Andrew Carnegie transferred to 27 trustees a fund of $10,000,000 in 5 per cent. first mortgage bonds, the revenue of which will be used to "hasten the abolition of international war" and to establish lasting world peace. The foundation is to be perpetual, and when the establishment of universal peace is attained the donor provides that the revenue shall be devoted to the banishment of the "next most degrading evil or evils."

COAL MINE ACCIDENTS IN NORTH AMERICAN MINES.

The loss of life in the production of anthracite and bituminous coal during 1910 involved the loss of 3,051 lives in 21 States and Provinces of the United States and Canada, as compared with 2,417 fatalities for the corresponding period in 1909, an increase of 634, or 26.23 per cent. The fatality rate for 1910 was 4.18 per 1,000 persons employed, as against 3.39 for 1909, an increase of 0.79 per 1,000, or 23.3 per cent. The rate for 1910 was the highest on record for the last decade, the nearest approach thereto having been in 1907, when the rate was 4.15 per 1,000.

The loss of life based on actual numbers was greatest in the Pennsylvania anthracite region, where 601 deaths occurred, followed by the bituminous region of Pennsylvania with 539, Illinois with 406, West Virginia with 320, and Colorado with 319. During 1910 the highest rate prevailed in Colorado, where it was 21.6 per 1,000. The only higher rates reported for any one state and year of the decade ending 1910, were for British Columbia, 25.67 for 1901 and 34.65 for 1902; and for Tennessee, 25.8 for 1902. Next to the State of Colorado the highest rate during 1910 is reported for Alabama, where it attained 10.81 per 1,000. Other states with rates above the average for the year were: Illinois, with 5.44; New Mexico, with 4.89; Oklahoma, with 5.43; Utah, with 4.38; Washington, with 7.15; and West Virginia, with 5 per 1,000. The states with the next lowest rates were: Iowa, where the rate was 2.17; Kansas, with 2.26; Indiana, with 2.41; and Michigan, with 2.43. The highest average fatality rate for the decade ending with 1910 was for the Province of British Columbia, or 9.21 per 1,000, followed by the State of Colorado, with an average of 8.39. The lowest averages were reported for Missouri, where the rate was only 1.48 per 1,000; followed by Iowa, with a rate of 2.09.

The accompanying profile shows graphically the fluctuations in and gradual increase of the death rate during the period 1886 to 1910. The lowest rate of 2.23 per 1,000 in 1887 has never since been approached, with the exception of 1897, when it dropped to 2.33. Since 1900, the rate has never been below 3 per 1,000, and from this point on there has been a rapid and uniform increase.



INCREASE IN FATALITY RATE
1886–1910
F. L. Hoffman in Coal Age

COAL.

During the year 1909 there were 309,618,885 short tons of bituminous coal and 70,221,195 short tons of Pennsylvania anthracite or a total of 379,840,080 short tons of coal loaded at the mines for shipment; 11,959,722 short tons of bituminous, and 2,201,997 short tons or 14,161,719 short tons in all sold to local trade and used by employees; 9,488,039 short tons of bituminous and 8,647,167 short tons of bituminous anthracite or a total of 18,135,206 short tons used at the mines for steam and heat. There were 48,677,611 short tons of coal made into coke during the year. Thus a total quantity of 379,744,257 tons of bituminous coal and 81,070,359 tons of anthracite or a total of 460,814,616 tons of coal were produced during the year. The total value of the coal produced was $554,668,364, of which $405,486,777 was for the bituminous coal and $149,181,587 for the Pennsylvania anthracite. The average price per ton of bituminous coal at the mines was $1.07 and for Pennsylvania anthracite $1.84. The average number of men employed in the mines was 666,555.

In 1910 there were 416,592,447 tons of coal loaded at the mines for shipment; 14,307,423 tons sold to local trade and used by employees; 18,509,058 tons used at the mines for steam and heat; and 52,187,450 tons made into coke; thus making the total production of coal for the year 1910 501,506,578 short tons, of which amount 84,485,236 were Pennsylvania anthracite and 417,111,142 bituminous. The total value, at an average price of $1.25 per ton, was $629,557,021. The average number of days the mines were active was 220 and the average number of employees 725,030.

During the year 1910 there were 169,497 men employed in the anthracite coal mines of the United States. They worked on an average 229 days out of the year. The average production per man in 1910 was 498 short tons and the average daily tonnage per man was 2.17 tons. In the bituminous fields there were 555,533 men employed during the year 1910 and they worked on an average 217 days a year. The average production per man in the bituminous mines was 751 tons and the average daily tonnage per man was 3.46 tons.

During the year 1910, there were 3,021,627 tons of anthracite coal with a value of $14,785,387, and 10,784,239 tons of bituminous and shale, with a value of $26,685,405. exported from the United States. The anthracite imports, valued at $42,244, amounted to 8,195 tons, and the bituminous and shale imports, valued at $3,975,561, 1,497,709 tons

Since 1899, the United States has ranked first in the coal-producing nations of the world and Great Britain has ranked second. In 1910, the United States produced 501,596,378 tons of coal; Great Britain, 296,007,699 tons; Germany, 245,043,120 tons; Austria-Hungary, 54,573,788 tons; France, 42,516,232 tons; Belgium, 26,374,986 tons; and Russia and Finland, 24,967,095 tons. The grand total production of coal in the world amounts to 1,278,577,812 tons.

A summary of the strikes in the coal mines of the United States shows that there were during the year 1910, 218,493 men on strike and that there were 19,250,524 working days lost or an average of 88 working days per man.

PER CENT. OF FATAL ACCIDENTS IN COAL MINES OF NORTH AMERICA DUE TO EACH CAUSE DURING A TEN-YEAR PERIOD.

Cause.	Fatal accidents.	
	Number.	Per cent of total.
Fall of coal	2,722	14.8
Fall of roof, slate, etc.	5,828	31.8
Falling into shafts	369	2.0
Falling into slopes, manways, etc.	125	.7
Mine cars	2,204	12.0
Outside cars	479	2.6
Motors	39	.2
Explosions:		
Dust or gas	2,571	14.0
Powder or dynamite	968	5.3
Blast	793	4.3
Other, not specified	292	1.6
Mining machinery	332	1.8
Mules	73	.4
Asphyxiation	271	1.5
Electrocution	193	1.0
Miscellaneous	1,105	6.0
Total	18,346	100.0

F. L. Hoffman in Bulletin of Bureau of Labor.

ACCIDENTS IN TRANSPORTATION OF EXPLOSIVES.

	HIGH EXPLOSIVES.		BLACK POWDER.		OTHER EXPLOSIVES.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
1908	5	7	24	20	7	61
1909	.....	.....	6	3	.....	4
1910	.....	.....	2	0	.....	1
1911	.....	3	.....	.....	1	2
Totals	5	10	32	23	8	68

RECAPITULATION.

	Total Killed.	Total Injured.
1908	36	88
1909	6	7
1910	2	1
1911	1	5
	45	101

ACCIDENTS IN MANUFACTURE, STORAGE OR USE OF EXPLOSIVES.

	HIGH EXPLOSIVES.		BLACK POWDER.		OTHER EXPLOSIVES.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
1908	82	65	23	23	20	91
1909	122	84	17	25	10	41
1910	80	110	13	7	3	24
1911	53	25	40	31	3	7
Totals	337	284	93	86	36	163

RECAPITULATION.

	Total Killed.	Total Injured.
1908	125	179
1909	149	150
1910	96	141
1911	96	63
	466	533

Central Bureau of International Geodesy Established Upon the Telegraphberg, Near Potsdam.

This central bureau has existed since 1866. After the creation of the Prussian Geodetic Institute it was united with the latter in 1869. The object of the Geodetic Institute is to cultivate geodesy by scientific researches, to execute the astronomical and physical determinations which, joined with the geodetic determinations, may serve in the exploration of the surface of the earth, more particularly within Prussian territory.

The labors of the institute for the present bear more particularly upon the astronomical determinations of the vertical in longitude and latitude, as well as upon astronomical data upon as many points of the geodetic system as possible; moreover, upon the determination of zenithal distances for convenient points, also upon the determination of the density and force of gravitation; it devotes its attention, furthermore, to researches upon the mean level and variations in the sea-level; to the examining into the refraction of luminous rays by the atmosphere; finally, it is occupied with all theoretical and experimental researches which contribute to the examination of the surface and the geodesy of the country.

The Geodetic Institute is placed under the immediate supervision of the Minister of Ecclesiastical Affairs, Public Instruction, and Medical Affairs of Prussia.

The Academy of Sciences is the consulting organ of the Minister in all the important affairs of the Institute. Conformably to the conventions agreed upon between the contracting parties, the Institute performs the functions of a Central Bureau for international geodesy. The director of the bureau is at the same time director of the Institute.—Almanach de Gotha.

FATAL-ACCIDENT RATE IN THE COAL MINES OF NORTH AMERICA DURING A TEN-YEAR PERIOD, BY CAUSES.

Cause.	Fatal accidents.	
	Number.	Rate per 10,000 employees.
Fall of coal	2,722	4.99
Fall of roof, slate, etc.	5,828	10.68
Falling into shafts	369	.68
Falling into slopes, manways, etc.	125	.23
Mine cars	2,204	4.04
Outside cars	470	.86
Motors	30	.05
Explosions:		
Dust or gas	2,571	4.71
Powder or dynamite	968	1.77
Blast	793	1.45
Other, not specified	292	.53
Mining machinery	332	.61
Mules	73	.13
Asphyxiation	271	.50
Electrocution	193	.35
Miscellaneous	1,105	2.02
Total	18,346	33.60

FATAL-ACCIDENT RATE PER 1,000 EMPLOYEES AND NUMBER OF LIVES LOST PER MILLION TONS MINED IN NORTH AMERICA, BY STATES AND PROVINCES, 1866 TO 1908.

State or Province.	Years considered.	Tons of coal produced.	Employees.	Fatal accidents.		Lives lost per 1,000,000 tons of coal mined.
				Number.	Per 1,000 employees.	
Alabama	16	142,592,400	227,828	1,037	4.55	7.27
Arkansas	6	12,307,804	25,651	76	2.96	6.17
Colorado	25	117,663,271	188,054	1,074	5.71	9.13
Illinois	26	611,071,223	1,030,800	2,407	2.34	3.94
Indiana	24	146,490,472	245,115	547	2.23	3.73
Iowa	21	109,736,706	264,400	573	2.17	5.22
Kansas	22	86,096,365	184,895	415	2.24	4.82
Kentucky	22	112,218,992	218,866	375	1.71	3.34
Maryland	19	84,322,336	93,269	165	1.77	1.96
Michigan	10	13,081,027	23,356	68	2.91	5.20
Missouri	19	61,065,829	151,444	261	1.72	4.27
Montana	18	24,464,869	37,557	138	3.67	5.64
New Mexico	14	19,243,519	29,325	212	7.23	11.02
North Dakota	1	320,742	631	4	6.34	12.47
Ohio	34	467,312,293	863,812	1,845	2.14	3.95
Oklahoma	15	33,906,783	90,774	460	5.07	13.57
Pennsylvania:						
Anthracite	39	1,782,024,124	4,344,074	14,625	3.37	8.21
Bituminous	32	1,806,371,376	2,729,155	6,919	2.54	3.83
Tennessee	18	69,368,153	143,029	627	4.38	9.04
Utah	16	17,754,456	24,424	235	11.67	16.05
Washington	17	38,231,315	68,645	464	6.76	12.14
West Virginia	25	453,581,594	625,566	2,887	4.62	6.36
Wyoming	5	26,140,782	29,227	339	11.60	12.97
Total		6,235,366,431	11,639,897	35,803	3.08	5.74
British Columbia		22,106,271	68,698	497	7.23	22.48
Nova Scotia		90,512,879	236,998	720	3.04	7.95
Total		112,619,150	305,696	1,217	3.98	10.81
Grand total		6,347,985,581	11,945,593	37,020	3.10	5.83

F. L. Hoffman in Bulletin of Bureau of Labor.

CHRONOLOGICAL LIST OF PRINCIPAL COAL MINE DISASTERS IN NORTH AMERICA.

Year.	Date.	Name of mine, or locality, and State.	Lives lost.	Year.	Date.	Name of mine, or locality, and State.	Lives lost.
1869	Sept.....	Avondale, Pa.....	179	1902	July 10....	Johnstown, Pa.....	112
1873	.....	Drummond, Nova Scotia	73	1902	July 16....	Park City, Utah.....	34
1880	Mar. 29....	Richhill, Mo.....	23	1902	Aug. 7....	Bowen No. 3 mine, Colo.	16
1880	.....	Fort Pitt, Nova Scotia..	44	1902	Sept. 15...	Algoma, W. Va.....	17
1883	Feb. 16....	Braidwood, Ill.....	69	1903	Jan. 23....	Primero, Colo.....	24
1883	Nov. 23...	Kettle Creek, Pa.....	17	1903	July 1.....	Hanna, Wyo.....	235
1884	Jan. 24....	Crested Butte, Colo.....	59	1903	Nov. 21...	Ferguson mine, Pa.....	17
1884	Feb. 20....	West Leisenring, Pa....	19	1904	Jan. 25....	Harwick mine, Pa.....	179
1884	Mar. 13...	Pocahontas mine, W. Va.	114	1904	Apr. 3.....	Zeigler, Ill.....	53
1884	.....	Johnstown mine, Pa....	14	1904	Apr. 23....	Eleanora shaft, Pa.....	13
1885	.....	McBeam mine, Nova Scotia.....	13	1904	Dec. 1.....	Diamond mine, Mo.....	18
1890	May 15....	Ashley mine, Pa.....	26	1905	Jan. 4.....	Bluefields, W. Va.....	22
1890	June 16....	Hill Farm mine, Pa.....	31	1905	Jan. 18....	Panther Creek, W. Va..	18
1891	Jan. 27....	Mammoth mine, Pa.....	109	1905	Feb. 20....	Virginia City, Ala.....	108
1891	Feb. 21....	Spring Hill, Nova Scotia	125	1905	Feb. 27....	Welch, W. Va.....	15
1892	July 23....	York Farm mine, Pa....	15	1905	Mar. 18-19.	Rush Run, W. Va.....	24
1893	Jan. 10....	Como, Colo.....	24	1905	Apr. 3.....	Zeigler, Ill.....	47
1894	Feb. 13....	Gayland, Pa.....	13	1906	Jan. 4.....	Coaldale, W. Va.....	22
1896	Feb. 18....	Vulcan mine, Colo.....	49	1906	Jan. 18....	Detroit and Kanawha, W. Va.	18
1896	Mar. 23....	Berwind mine, Pa.....	13	1906	Feb. 8.....	Parrall mine, W. Va....	23
1896	June 28...	Twin Shaft mine, Pittston, Pa.....	58	1906	Mar. 22....	Century, W. Va.....	23
1899	June 16...	Caledonia mine, Nova Scotia.....	11	1906	Apr. 21....	Trinidad, Colo.....	23
1899	Dec. 10....	Carbonado mine, Wash.	33	1907	Jan. 23....	Primero, Colo.....	20
1899	Dec. 23....	Brazella mine, Pa.....	20	1907	Jan. 26....	Penco, mine, W. Va.....	12
1899	Dec. 23....	Sumner mine, Pa.....	19	1907	Jan. 29....	Stuart, W. Va.....	85
1899	.....	North Carolina.....	22	1907	Feb. 4.....	Thomas mine, W. Va...	25
1900	Mar. 6.....	Red Ash mine, W. Va..	46	1907	May 1.....	Whipple mine, W. Va...	16
1900	May 1.....	Schofield, Utah.....	200	1907	Dec. 1.....	Naomi mine, Pa.....	34
1900	Nov. 2....	Berryburg, W. Va.....	15	1907	Dec. 6.....	Monongah No. 8 mine, W. Va.	359
1901	Feb. 15....	Union mine No. 6, British Columbia.....	63	1907	Dec. 19....	Darr mine, Pa.....	239
1901	Mar. 2.....	Diamond mine, Wyo....	28	1908	Jan. 12....	Lick Branch, W. Va....	105
1901	May 15....	Chatham, W. Va.....	10	1908	May 1.....	Mount Lookout, Pa.....	12
1901	June 10....	Port Royal mine, Pa.....	20	1908	Aug. 26...	Halleyville, Okla.....	29
1901	Sept. 30...	Extension mine, British Columbia.....	16	1908	Nov. 28...	Mariana mine, Pa.....	154
1902	Jan. 14....	Milby and Dowe mine, Ind. T.....	10	1909	Jan. 10....	Lieter mine, Ill.....	26
1902	Jan. 25....	Lost Creek mine, Iowa...	22	1909	Nov. 13...	St. Paul mine, Cherry, Ill.	266
1902	May 19....	Fraterville, Tenn.....	184	1909	Dec. 28....	Lick Branch, W. Va....	51
1902	May 22....	Fernie mine, British Columbia.....	127	1910	Jan. 31....	Primero, Colo.....	75
				1910	Feb. 1.....	Drakesburg, Ky.....	30
				1910	Apr. 20....	Mulga, Ala.....	40
				1910	Apr. 21....	Amsterdam mine, Ohio.	16
				1910	May 5.....	Palos, Ala.....	83

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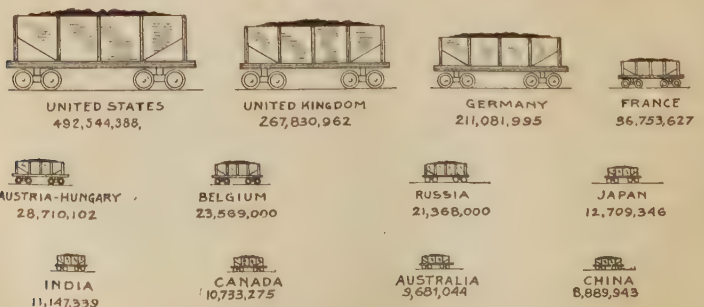


COAL.
A YEAR'S PRODUCTION.
(in tons.)

PRICE OF COAL.

[Sources: Anthracite, for shipment beyond the Delaware Capes, American Iron and Steel Association; bituminous, Saward's Coal Trade Journal.]

Calendar year.	Anthracite.	Bituminous.	Calendar year.	Anthracite.	Bituminous.	Calendar year.	Anthracite.	Bituminous.
	Dollars.	*Dollars.*		*Dollars.*	*Dollars.*		*Dollars.*	*Dollars.*
1855	4.49	3.89½	1874	4.55	4.50	1893	3.90	[1] 2.40
1856	4.11	3.75	1875	4.39	4.35	1894	3.90	[1] 2.25
1857	3.87	4.28	1876	3.87	3.87	1895	3.50	[1] 2.00
1858	3.43	3.70	1877	2.59	3.15	1896	3.50	[2] 2.28
1859	3.25	3.63	1878	3.22	2.86	1897	3.50	[2] 1.80
1860	3.40	3.49	1879	2.70	2.79	1898	3.50	[2] 1.60
1861	3.39	3.44	1880	4.53	3.75	1899	3.75	[2] 2.00
1862	4.14	4.23	1881	4.53	3.75	1900	3.47	2.50
1863	6.06	5.57	1882	4.61	3.50	1901	3.80	2.50
1864	8.39	6.84	1883	4.54	2.90	1902[3]	4.50	2.50
1865	7.86	7.57	1884	4.42	2.50	1903	4.50	3.35
1866	5.80	5.94	1885	4.10	2.25	1904	4.50	2.25
1867	4.37	4.97	1886	4.00	2.10	1905	4.50	2.60
1868	3.86	4.71	1887	4.05	3.45	1906	4.50	2.75
1869	5.31	4.97	1888	4.21	[1] 2.60	1907	[4] 4.50	2.80
1870	4.39	4.72	1889	4.04	[1] 2.60	1908	[4] 4.50	[5] 2.70
1871	4.46	4.72	1890	3.92½	[1] 2.60	1909	[4] 4.50	[5] 2.60
1872	3.74	4.66	1891	3.85	[1] 2.60	1910	[4] 4.50	[6] 2.60
1873	4.27	4.84	1892	3.97½	[1] 2.50	1911	[4] 4.50	[6] 2.60

[1] The price on board fixed at Baltimore by the Seaboard Coal Association.
[2] Price of soft-coal pool.
[3] Owing to unusual conditions in the coal market the association price for 1902 is not a correct guide as to the actual selling price, Clearfield coal selling as high as $7 at the mines and as high as $9 in New York Harbor. Unsettled conditions lasted until Mar. 1, 1903, or nearly so; then, on Apr. 1, prices were made $3.30 at Baltimore; later on in the year this price was discounted from 10 to 15 per cent.
[4] Shipments nominal. No sales made in 1909, 1910, or 1911.
[5] Cumberland coal now includes "thin seam" as well as "big vein" coal, the former selling about 25 cents per ton lower than the latter.
[6] Freight on "big vein" coal to Baltimore having been reduced 15 cents, $2.60 in 1909 and subsequent years is equivalent to $2.75 in 1908 and previous years.

COAL RESERVES BY STATES.

Coke.

The production of coke in 1910 amounted to 41,708,810 short tons (7,138,734 tons from retort ovens), valued at $99,742,701, and the average price paid per ton for the same period was $2.39. The average output from the by-product ovens in 1910 was 1,762 short tons per oven. The average output from beehive ovens in 1910 was 376 tons per oven. The imports of coke were valued at $625,130 in 1910, and the exports at $3,053,293.

The value and quantity of products obtained in the manufacture of coke in retort ovens were as follows: gas, 27,692,858 thousand cubic feet, valued at $3,017,908; tar, 66,303,214 gallons, valued at $1,599,453; ammonia sulphate or reduced to equivalent in sulphate, 70,247,543 pounds, valued at $1,841,062; ammonia liquor, 4,654,282 gallons, valued at $295,868; anhydrous ammonia 20,229,421 pounds, valued at $1,725,266; thus making the total value of the by-products of coke $8,479,557. The value of the coke manufactured in retort ovens was $24,793,016 and the total value of all the products obtained in the manufacture of coke was $33,272,573.

Natural Gas.

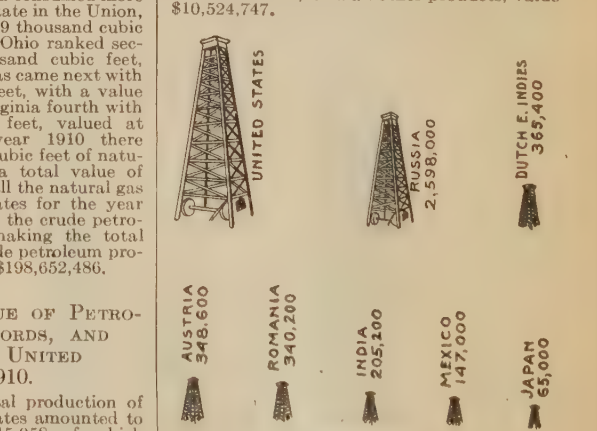
The value of natural gas produced in 1910 was $70,756,158,as compared with $63,206,941 in 1909. No imports of natural gas in 1910 were reported. Pennsylvania consumed more natural gas than any other state in the Union, the amount being 168,875,559 thousand cubic feet, valued at $23,934,691; Ohio ranked second with 108,074,660 thousand cubic feet, valued at $21,210,965; Kansas came next with 81.929,740 thousand cubic feet, with a value of $9,163,863; and West Virginia fourth with 77,067,756 thousand cubic feet, valued at $5,617,910. During the year 1910 there were 509,155,309 thousand cubic feet of natural gas consumed, having a total value of $70,756,158. The value of all the natural gas produced in the United States for the year 1910 was $70,756,158 and of the crude petroleum, $127,896,328; thus making the total value of natural gas and crude petroleum produced in the United States $198,652,486.

Production and Value of Petroleum. Well Records, and Acreage for the United States in 1910.

In the year 1910 the total production of petroleum in the United States amounted to 198,026,646 barrels; 173,545,058 of which were placed to the credit of the producer, and 24,481,588 to the land-owner. The total value of this petroleum was $118,955,429, and the average price per barrel was $0.601. On January 1, 1910, the stock at the wells amounted to 9,014,441 barrels, and on December 31, to 11,778,827 barrels. On January 1, 1910, there were 147,118 productive wells in the United States; and on December 31, there were 148,440. At this time there were 1,129 wells drilling. The average production per well per day amounted to 3.7 barrels. The total acreage in wells in the United States in 1910 amounted to 9,280,568.

Petroleum Refining.

The products of the petroleum-refining industry, statistics for which are presented below, aggregated $236,997,659 in value in 1909 as compared with $123,929,384 in 1899, the increase during the decade being 91.2 per cent. This conforms closely with the increase in the cost of crude petroleum used which was 89.4 per cent. The crude petroleum used increased in quantity from 52,011,005 barrels of 42 gallons in 1899 to 120,775,439 barrels in 1909, or 132.2 per cent., and the refined-oil products aggregated 40,290,985 barrels of 50 gallons in 1899 and 89,082,810 barrels in 1909, an increase of 136.2 per cent. for the decade. The total amount of crude petroleum used for refining purposes was 120,775,439 barrels of 42 gallons each, valued at $152,307,040. The products of the refining process were as follows: Illuminating oils, 33,495,798 barrels (50 gallons), value, $94,547,010; fuel oils (including gas oils), 34,034,577 barrels, value $36,462,883; lubricating oils, 10,745,885 barrels, valued at $38,884,236; naphtha and gasoline (including gas naphtha), 10,806,550 barrels, value $39,771,959; paraffin wax, 946,830 barrels, value $9,388,812; oil asphaltum, 233,328 short tons, value $2,724,752; residuum or tar, 1,787,008 barrels, value $2,215,623; greases (lubricating, etc.), 138,302 barrels, value $1,567,647; coke and black naphtha, value $507,695; sludge acid, 133,215 short tons, value $402,295; and all other products, value $10,524,747.



PETROLEUM.
A YEAR'S PRODUCTION
(in thousands of gallons.)

Aluminum.

The consumption of aluminum during 1910 was 47,734,000 pounds, valued at $8,955,700, against 7,150,000 pounds in 1900, 61,281 pounds in 1890 and 83 pounds in 1883. The imports of aluminum salts in 1910 were valued at $53,671, and the exports of manufactures of aluminum at $949,215.

WORLD'S PRODUCTION OF CRUDE PETROLEUM, 1906–1910, BY COUNTRIES.

[Barrels of 42 gallons.]

Country.	1906	1907	1908	1909	1910			
					Rank.	Barrels.	Metric tons.	Per cent of total production.
United States.	126,493,936	166,095,335	178,527,355	183,170,874	1	209,556,048	27,940,806	63.99
Russia	58,897,311	61,850,734	62,186,447	65,970,350	2	70,336,574	9,378,210	21.48
Galicia	5,467,967	8,455,841	12,612,295	14,932,799	3	12,673,688	1,762,560	3.87
Dutch East Indies	8,180,657	9,982,597	10,283,357	11,041,852	4	11,030,620	1,495,715	3.37
Roumania	6,378,184	8,118,207	8,252,157	9,327,278	5	9,722,958	1,352,289	2.97
India	4,015,803	4,344,162	5,047,038	6,676,517	6	6,137,990	818,400	1.87
Mexico	.....	1,000,000	3,481,410	2,488,742	7	3,332,807	444,374	1.02
Japan	1,710,768	2,010,639	2,070,145	1,889,563	8	1,930,561	257,421	.59
Peru	536,294	756,226	1,011,180	1,316,118	9	1,330,105	177,347	.40
Germany	578,610	756,631	1,009,278	1,018,837	10	1,032.522	145,168	.32
Canada	569,753	788,872	527,987	420,755	11	315,895	42,119	.10
Italy	53,577	59,875	50,966	42,388	12	42,388	5,895	.02
Other	a 30,000	a 30,000	a 30,000	a 30,000	13	a 30,000	4,000	
Total	212,912,860	264,249,119	285,089,615	298,326,073	.....	327,472,256	43,824,304	100.00

a Estimated.

Quantity of Petroleum Produced in, and Quantities and Value of Petroleum Products Exported from, the United States.

The total exports of petroleum from the United States during the year 1910 amounted to 1,502,491,933 gallons, and were valued at $94,107,022. The exports of mineral, crude (including all natural oils, without regard to gravity) oils, was 180,111,166 gallons, valued at $5,404,253; the exports of mineral, refined, or manufactured naphtha, benzine, gasoline, etc., totaling 100,695,382 gallons, was valued at $8,407,102; the exports of mineral, refined, or manufactured illuminating oils was 940,247,039 gallons, valued at $55,642,268; the export of mineral, refined, or manufactured lubricating (heavy paraffine, etc.), oils amounting to 163,832,544 gallons, was valued at $20,921,103; and the export of residuum (tar, pitch, and all other, from which the light bodies have been distilled), valued at $3,732,196, amounted to 117,605,802 gallons.

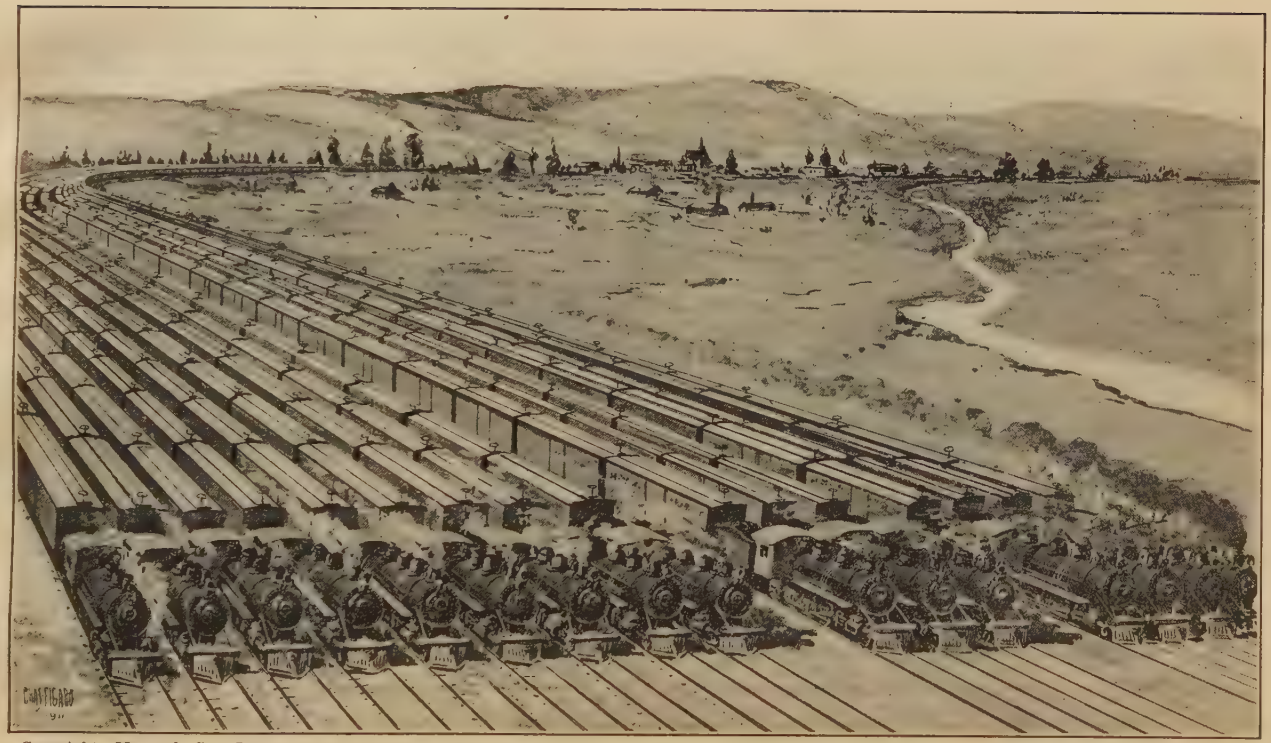
Cement.

The total quantity of Portland, natural, and puzzolano cement produced in the United States during 1910 was 77,785,141 barrels, valued at $68,752,092. As compared with 1909, when the production was 66,689,715 barrels, valued at $53,610,563, the year 1910 showed an increase of 11,095,426 barrels, or 16.6 per cent. in quantity, and an increase of $15,141,529, or 28.2 per cent. in value. In 1910 the quantity of Portland cement produced was 76,549,951 barrels, valued at $68,205,800; the production of natural cement amounted to 1,139,239 barrels, valued at $483,006; and the production of puzzolano cement was 95,951 barrels, valued at $63,286.

From 1818 when the first natural cement was used, 300,000 barrels, up to the year 1899, when the maximum amount, 9,868,179 barrels, was used, the consumption of natural cement constantly grew. Since 1899, however, the consumption has gradually decreased, until in 1910 the production only amounted to 1,139,239 barrels. The future of natural cement depends entirely upon means of improvement in the manufacture of the cement, whereby it may be brought nearer to the specifications for high-grade Portland cement. The decline in the use of natural cement has been due principally to the greater tensile strength of Portland cement.

During the year 1910 the domestic production of cement amounted to 76,549,951 barrels, and the imports to 306,863 barrels. The total available supply of Portland cement for this period amounted to 76,006,348 barrels. The exports of Portland cement during the year amounted to 2,475,957 barrels; thus making the apparent consumption 74,380,857 barrels.

The total production of pig-iron for the year 1911 was 23,649,547 tons against 27,303,567 tons in 1910. On June 30, 1911, there were 212 furnaces in blast and on December 31 there were 231. The total number of furnaces on December 31, 1911, was 466.



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PART OF THE 74,000,000 BARRELS OF CEMENT MANUFACTURED IN 1910 AND WHERE IT WENT.

To Panama Canal in 1910: 2,100,000 barrels of cement, which would fill 9 trains each 10 miles in length and consisting of 1,400 cars.
To Florida-Key West Railroad: 800,000 barrels of cement. Three trains each over 10 miles long.
To Ashokan Dam: 1,000,000 barrels. Four trains over 10 miles long.

Copyright by Munn & Co., Inc. 1910-$0.75 1900-$1.00 1890-$2.00 1880-$3.00

CEMENT MARKET AND ITS GROWTH IN THE PAST 30 YEARS.

Portland Cement manufactured in 1910 would fill a barrel 980 feet high—just short of the Eiffel Tower. Note the enormous increase of cement production by decades and the corresponding drop in price per barrel at the mill.

Clay Products.

The value of all clay products in 1910 was $170,115,974; the pottery products being valued at $33,784,678 and the brick and tiles at $136,331,296. The various kinds of clay together with their amount and value were as follows: Kaolin, 34,221 short tons, valued at $255,873; paper clay, 85,949 tons, valued at $420,476; slip clay, 17,696 tons, valued at $29,962; ball clay, 70,637 tons, valued at $257,265; fire clay, 1,638,931 tons, valued at $2,157,720; stoneware clay, 152,942 tons, valued at $153,044; brick clay, 173,625 tons, valued at $128,039; miscellaneous, 215,228 tons, valued at $223,106.

The imports of pottery in 1910 amounted to $11,127,405; the imports of bricks were valued at $206,613. The exports of brick in 1910 were valued at $1,602,913, and the exports of pottery at $1,041,689. The imports of kaolin or china clay in 1910 were valued at $1,593,472, and the imports of other clays amounted to $320,891.

Sand.

During the year 1910 there was 1,461,089 short tons of glass sand, valued at $1,516,711, produced in the United States; 3,636,167 tons of molding sand, valued at $2,431,254; 25,743,072 tons of building sand, valued at $7,832,638; 175,081 tons of fire sand, valued at $136,361; 878,411 tons of engine sand, valued at $349,145; 493,566 tons of furnace sand, valued at $279,046; other sands amounting to 4,438,428 tons, valued at $1,240,365; and 32,584,622 tons of gravel, valued at $7,252,110. Thus the total quantity of sand and gravel produced in the United States during the year 1910 amounted to 69,410,436 short tons, and the total value of same was $21,037,630. The imports of sand for the same year amounted to $133,757.

Salt.

The total value of the salt products of the United States for the year 1909, amounted to $11,327,834. There were 29,933,060 barrels of salt of 280 pounds each produced during this period and their total value was $8,311,729 —728,875 pounds of bromine, valued at $92,735; and $2,923,370 worth of all other salt products. The salt may be classified as table and dairy salt, 3,042,824 barrels; common fine, 7,745,204 barrels; common coarse, 2,843,393 barrels; packers, 385 802; coarse solar, 1,109,396; rock salt mined, 5,938,721; and milling, other grades, and brine, 8,867,720 barrels. There were 124 establishments producing salt, 46 of which used the solar process for preparing this salt; 1 the kettle process; 50 the grainer process; 11 the open pan process; and 21 the vacuum pan process. In 1910 the total production of salt in the United States and Hawaii and Porto Rico, amounted to 30,305,656 barrels, valued at $7,900,344.

Slate.

The production of slate in 1910 was valued at $6,236,759. The imports of slate for the same period were valued at $4,127, and the exports of roofing slate were not reported separately in 1910.

Lime.

The production of lime in 1910 was 3,481,780 short tons, valued at $13,894,692, and the average price per short ton was $3.99 for the same period. The imports in 1910 were 6,498 short tons, valued at $63,791 and the exports reported in 1910 were 164,602 barrels, valued at $127,952.

Stone.

The value of all kinds of stone produced in the United States in 1910 amounted to $76,520,584. The imports of marble and stone were valued at $1,569,143, and the exports at $1,538,339. The value of the granite produced in the United States during 1910, was $20,541,967; of trap rock, $6,452,141; of sandstone, $6,394,832; of bluestone, $1,535,187: of marble, $6,992,779; and of limestone, $34,603,678.

Sulphur and Pyrite.

The domestic production of sulphur in 1910 was 255,534 long tons, valued at $4,605,112. The production of pyrite in 1910 was 238,154 long tons, valued at $958,608. The imports of sulphur rose to $558,611 in 1910. The exports in 1910 amounted to 30,742 long tons, valued at $552,941. The imports of pyrite were valued at $2,748,647 in 1910.

Pigments.

Barytes.—The production of crude barytes in 1910 was 42,975 short tons, valued at $121,746. The imports of barytes rose to $78,239 in 1910, and the imports of barium compounds to $470,449.

Mineral paints.—The commercial production of mineral paints in 1910 amounted to 85,685 short tons valued at $2,194,735.

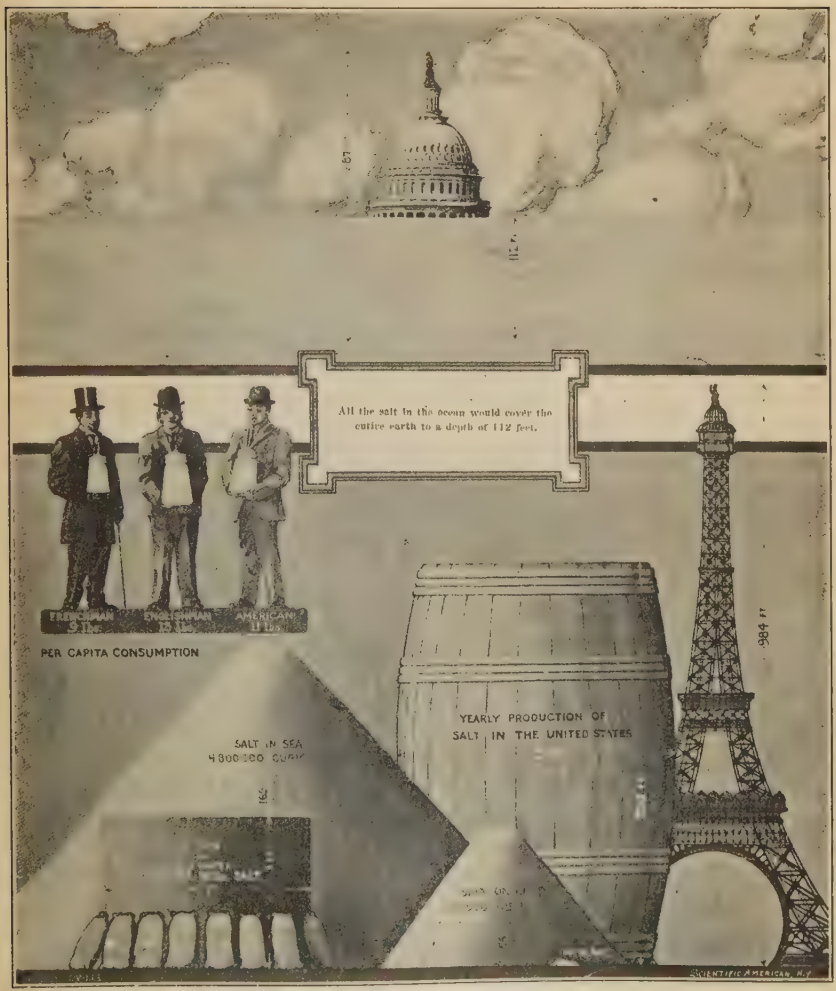
Zinc oxide.—The production of zinc oxide in 1910 amounted to 59,333 short tons, valued at $5,325,636. The imports of zinc oxide in 1910 were valued at $396,573 and the exports at $934,968.

Asphalt.

During the year 1909 the total production of asphalt and bituminous rock amounted to 228,655 short tons, valued at $2,138,273, and was divided into the following varieties: Bituminous rock. 55,376 short tons; valued at $205,756; refined bitumen, 733 short tons, valued at $6,964; gum, 10,220 tons, valued at $105,220; maltha, 652 tons, valued at $8,047; wurtzilite, 220 tons, valued at $1,400; gilsonite, 28,669 tons, valued at $218,186; grahamite, 3,894 tons, valued at $32,737; ozokerite and tabbyite, 30 tons, valued at $1,500; and oil asphalt, 128,861 tons, valued at $1,558,463. The great increase in the use of asphalt during the last year has been due to the impetus given to the building of better roads.

Nickel.

The production of nickel in 1910 was very small. The imports of nickel in 1910 were valued at $4,227,838, and the exports were valued at $4,704,088.


All the salt in the ocean would cover the entire earth to a depth of 112 feet.
PER CAPITA CONSUMPTION
YEARLY PRODUCTION OF SALT IN THE UNITED STATES
SALT IN SEA
984 FT
SCIENTIFIC AMERICAN N.Y.

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MAGNITUDE OF THE SALT INDUSTRY.

Salt in sea and on land.—Yearly production in the United States. 157,267,544 tons of sodium are annually poured into the sea. Of this amount, 77¾ per cent. is common salt.

GEMS AND PRECIOUS STONES.

Production of precious stones in the United States in 1907, 1908, 1909, and 1910.

	Value.				Remarks.
	1907	1908	1909	1910	
Agates, chalcedony, etc., moonstones, etc., onyx.	$650	$1,125	$750	$2,268	About 1,150 pounds; California, Colorado, Montana, and Wyoming.
Amethyst	850	210	190	.....	No production reported.
Azurmalachite, malachite, etc.	250	5,450	2,000	550	475 pounds; Arizona and Nevada.
Benitoite	1,500	3,638	500	.....	No production reported.
Beryl, aquamarine, blue, pink, etc.	6,435	7,485	1,660	5,545	About 30 pounds rough and selected.
Californite	a 25,000	.....	a 18,000	a 8,000	1,500 pounds; California; not sold.
Catlinite	25	.....	.....	.....	No production reported.
Chiastolite	20	.....	.....	.....	Do.
Chlorastrolite	.....	25	2,400	a 2,000	1,250 pounds; Michigan.
Chrysocolla	150	600	300	.....	No production reported.
Chrysoprase	a 46,500	a 48,225	a 84,800	a 9,000	1,700 pounds; California.
Cyanite	100	.....	.....	.....	No production reported.
Diamond	a 2,800	a 2,100	2,033	a 1,400	208 stones; Arkansas and California.
Diopside	.....	120	.....	.....	No production reported.
Emerald	a 1,320	.....	a 300	a 700	North Carolina.
Epidote	60	.....	15	.....	No production reported.
Feldspar, sunstone, amazon stone, etc.	1,110	2,850	a 2,700	2,510	4,128 pounds; Colorado and California.
Garnet, hyacinth, pyrope, almandine, rhodolite.	6,460	13,100	1,650	3,100	151 pounds; California, Arizona, and Colorado.
Gold quartz	1,000	1,010	.....	1,000	Colorado and California.
Jasper	675	.....	100	475	500 pounds; Colorado and California.
Opal	180	50	200	270	Nevada.
Peridot	1,300	1,300	300	.....	No production reported.
Petrified wood	325	.....	.....	.....	Do.
Phenacite	25	95	50	50	Colorado.
Prase	.....	.....	.....	100	50 pounds; Oregon.
Pyrite	400	.....	.....	.....	No production reported.
Quartz, rock crystal, smoky quartz, rutilated, etc.	2,580	3,595	2,689	1,385	1,753 pounds; Colorado, Maine, Vermont, California, and Texas.
Rose quartz	6,375	568	2,970	2,537	25,025 pounds; South Dakota and California.
Rhodocrosite	150	.....	.....	.....	No production reported.
Rhodonite	.....	1,250	125	a 6,200	3,200 pounds; Montana and California.
Ruby	2,000	.....	.....	.....	No production reported.
Rutile	200	.....	25	.....	Do.
Sapphire	a229,800	a 58,397	a 44,998	52,983	1,062,000 carats; Montana and Indiana.
Smithsonite	800	a 1,200	300	.....	No production reported.
Spodumene, kunzite, hiddenite.	14,500	a 6,000	15,150	33,000	120 pounds; California.
Thompsonite	.....	35	100	610	About 50 pounds; Michigan, Minnesota, and New Jersey.
Topaz	2,300	4,435	512	884	75 pounds; California, Colorado, and Texas.
Tourmaline	a 84,120	a 90,000	a133,192	a 46,500	1,548 pounds; California and Maine.
Turquoise and matrix	23,840	a147,950	a179,273	a 85,900	16,886 pounds; Nevada, New Mexico, Arizona, and Colorado.
Variscite, amatrice, utahlite	7,500	14,250	35,938	a 26,125	5,377 pounds; Utah and Nevada.
Miscellaneous gems	.....	.....	1,060	2,755	Datolite, obsidian, fossil coral, and ornamental stones with trade names.
Total	471,300	415,063	534,380	295,797	

a Estimated or partly so.

Miscellaneous.

Asbestos.—The asbestos commercially produced in the United States in 1910 was obtained from deposits in Georgia and Vermont, with small quantities from Idaho and Wyoming. The total commercial production in 1910 was 3,693 short tons, valued at $68,357. The imports for consumption were valued at $1,543,249 in 1910.

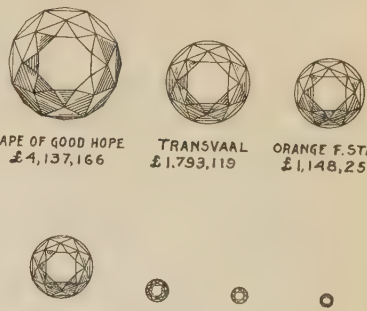
Graphite.—The commercial production of crystalline graphite during 1910 amounted to 5,590,592 pounds, valued at $295,733. The production of amorphous graphite in 1910 was 35,945 short tons, valued at $81,443. The production of artificial graphite in 1910 was 13,149,100 pounds, valued at $945,000, the average price being 7.2 cents per pound. The imports of graphite in 1910 were valued at $1,872,592.

Mica.—The total production of mica in 1910 was 2,476,190 pounds of sheet mica, valued at $283,832, and 4,065 short tons of scrap mica, valued at $53,265. The imports of mica in 1910 were valued at $724,525.

Mineral waters.—The total production of mineral waters in 1910 was 62,030,125 gallons, valued at $6,357,590. The imports of mineral waters in 1910 were valued at $983,136.

During the year 1910 there were 709 springs in the United States reporting sales of mineral waters. They sold 62,030,125 gallons of mineral waters valued at $6,357,590. Each year has shown a growth in the production of what is known as "soft drinks." In all 6,403,913 gallons of mineral spring water were used for this purpose. Wisconsin leads all the states in the amount of water used, she requiring 2,151,783, or about one-third of all the mineral water used, in the production of her soft drinks.

The total imports of iron ore into the United States in 1910 amounted to 2,591,031 long tons and the quantity of iron ore exported from the United States in the same year amounted to 644,875 long tons.



DIAMOND PRODUCTION.
(in Pounds Sterling.)

THE NATIONAL BUREAU OF MINES.

The National Bureau of Mines for the United States was created by act of Congress approved May 16, and effective July 1, 1910. The chief purpose of the bureau is to carry on inquiries and investigations with the view of lessening loss of life and waste of resources in mining and metallurgical operations. It is to make investigations of the methods of mining, especially in relation to the safety of miners, the appliances best adapted to the prevention of mine accidents, the improvement of mining conditions, the treatment of ores and other mineral substances, as to the use of explosives and electricity in mining, and other inquiries and technologic investigations pertaining to mining, metallurgical and quarry industries. The act establishing the bureau provides that no officer or employee of the Bureau of Mines shall exercise any right or authority in connection with the inspection or supervision of mines and metallurgical plants in any state; under the Constitution such inspection and supervision is within the province of the State and is not germane to the duties of the Federal Government.

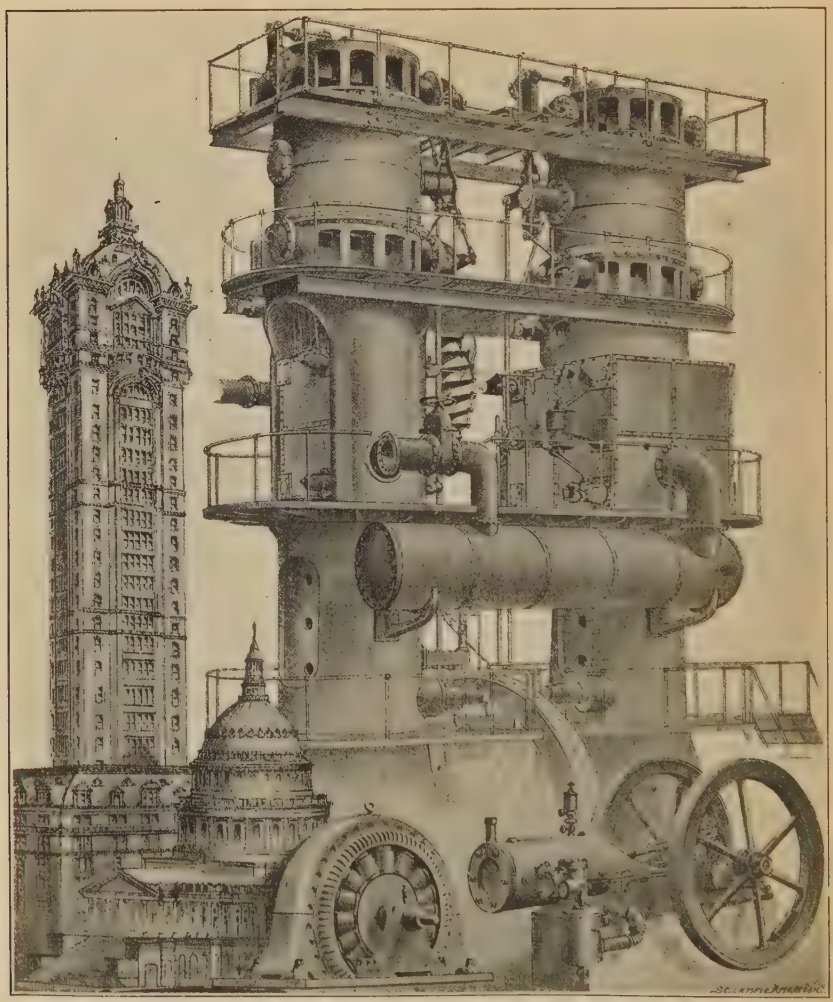
The scope of the fuel investigations of this bureau conforms to the provisions of the Act of Congress which provides for the analyzing and testing of coals, lignites, and other mineral fuel substances belonging to or for the use of the United States. Several lines of inquiry are embodied in this plan, which however, are too numerous to be mentioned here.

The act also transferred to the new Bureau of Mines the personnel and equipment of the technologic branch of the United States Geological Survey. This personnel and equipment were developed during the preceding five years in connection with the investigation of fuels and mine accidents, and the new bureau is to continue similar investigations.

Its chief Experimental Station is located at Pittsburgh, Pa., where the work in the laboratories is supplemented by experiments conducted in a small coal mine under the conditions of actual mining. At this station it also is conducting a number of investigations in connection with the use of explosives and electricity, and other mining problems.

As a means of carrying on an educational campaign in behalf of mine rescue and first aid to the injured work, the Bureau of Mines has purchased and equipped with rescue apparatus, first aid and fire fighting devices, seven cars of standard Pullman size, each completely fitted with modern appliances. These cars, one stationed in each of the important coal fields or coal mining regions of the country, will visit all the important groups of coal mines where demonstrations and illustrations of this work will be given.

The law establishing the Bureau of Mines became effective on July 1, 1910. On September 1st, Dr. J. A. Holmes, formerly Chief of the Technologic Branch of the Geological Survey, was appointed Director of the new Bureau.



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GRAPHIC REPRESENTATION OF THE ENORMOUS ENERGY EXPENDED IN MANUFACTURES IN THE UNITED STATES.

The total steam power employed in manufactures in the United States in 1905 was 10,664,560. A single steam engine of this power would measure 400 feet by 255 feet on the base, and would extend 735 feet into the air, or 123 feet above the Singer building. To develop the total electric horse-power of 1,138,208 would call for a generator with a 134-foot base, and 126 feet high. The total of 298,514 gas engine power would require an engine 350 feet long by 80 feet high. Now the Woolworth Building could be substituted for the Singer Building.

CHAPTER IV.

MANUFACTURES.

MANUFACTURES: A SUMMARY OF THE PRINCIPAL ESTABLISHMENTS IN THE UNITED STATES AND NON-CONTIGUOUS TERRITORY, 1909.

	NUMBER OR AMOUNT.				
	Total.	Continental United States.	Alaska.	Hawaii.	Porto Rico.
Number of establishments	270,082	268,491	152	500	939
Persons engaged in manufactures	7,707,751	7,678,578	3,479	7,572	18,122
Proprietors and firm members	275,952	273,265	135	1,074	1,478
Salaried employees	792,168	790,267	245	594	1,062
Wage earners (average number)	6,639,931	6,615,046	3,099	5,904	15,582
Primary horsepower	18,760,686	18,680,776	3,975	41,930	34,005
Capital	$18,490,749,000	$18,428,270,000	$13,060,000	$23,875,000	$25,544,000
Expenses	18,525,426,000	18,453,080,000	9,454,000	31,753,000	31,139,000
Services	4,375,634,000	4,365,613,000	2,328,000	2,795,000	4,898,000
Salaries	940,900,000	938,575,000	380,000	686,000	1,259,000
Wages	3,434,734,000	3,427,038,000	1,948,000	2,109,000	3,639,000
Materials	12,194,019,000	12,141,791,000	5,120,000	25,629,000	21,479,000
Miscellaneous	1,955,773,000	1,945,676,000	2,006,000	3,329,000	4,762,000
Value of products	20,767,546,000	20,672,052,000	11,340,000	47,404,000	36,750,000
Value added by manufacture (value of products less cost of materials)	8,573,527,000	8,530,261,000	6,229,000	21,775,000	15,271,000

A SUMMARY OF THE PRINCIPAL ESTABLISHMENTS OF THE UNITED STATES FOR SPECIFIED YEARS: 1909, 1904, 1899; AND THE PER CENT. OF INCREASE.

	NUMBER OR AMOUNT.			PER CENT OF INCREASE.	
	1909	1904	1899	1904–1909	1899–1904
Number of establishments	268,491	216,180	207,514	24.2	4.2
Persons engaged in manufactures	7,678,578	6,213,612		23.6	
Proprietors and firm members	273,265	225,673		21.1	
Salaried employees	790,267	519,556	364,120	52.1	42.7
Wage earners (average number)	6,615,046	5,468,383	4,712,763	21.0	16.0
Primary horsepower	18,680,776	13,487,707	10,097,893	38.5	33.6
Capital	$18,428,270,000	$12,675,581,000	$8,975,256,000	45.4	41.2
Expenses	18,453,080,000	13,138,260,000	9,870,425,000	40.5	33.1
Services	4,365,613,000	3,184,884,000	2,389,132,000	37.1	33.3
Salaries	938,575,000	574,439,000	380,771,000	63.4	50.9
Wages	3,427,038,000	2,610,445,000	2,008,361,000	31.3	30.0
Materials	12,141,791,000	8,500,208,000	6,575,851,000	42.8	29.3
Miscellaneous	1,945,676,000	1,453,168,000	905,442,000	33.9	60.5
Value of products	20,672,052,000	14,793,903,000	11,406,927,000	39.7	29.7
Value added by manufacture (value of products less cost of materials)	8,530,261,000	6,293,695,000	4,831,076,000	35.5	30.3

CONDITIONS OF MANUFACTURES IN THE UNITED STATES AT EACH CENSUS: 1849–1909 (CONTINENTAL UNITED STATES ONLY.)

	Number of establishments.	Capital.	Wage earners (average number)	Wages.	Cost of materials.	Value of products.	Value added by manufacture.
Factories and hand and neighborhood industries:							
1849 (census of 1850)	123,025	$533,245,000	957,059	$236,755,000	$555,124,000	$1,019,107,000	$463,983,000
1859 (census of 1860)	140,433	1,009,856,000	1,311,246	378,879,000	1,031,605,000	1,885,862,000	854,257,000
Per cent of increase, 1849 to 1859	14.1	89.4	37.0	60.0	85.8	85.0	84.1
1869 (census of 1870) (gold value)	252,148	1,694,567,000	2,053,996	620,467,000	1,990,742,000	3,385,860,000	1,395,118,000
Per cent of increase, 1859 to 1869	79.6	67.8	56.6	63.8	93.0	79.5	63.3
1879 (census of 1880)	253,852	2,790,273,000	2,732,595	947,954,000	3,396,824,000	5,369,579,000	1,972,755,000
Per cent of increase, 1869 to 1879	0.7	64.7	33.0	52.8	90.6	74.5	41.4
1889 (census of 1890)	355,405	6,525,051,000	4,251,535	1,891,210,000	5,162,014,000	9,372,379,000	4,210,365,000
Per cent of increase, 1879 to 1889	40.0	133.8	55.6	99.5	52.0	74.5	113.4
1899 (census of 1900)	512,191	9,813,834,000	5,306,143	2,320,938,000	7,343,628,000	13,000,149,000	5,656,521,000
Per cent of increase, 1889 to 1899	44.1	50.4	24.8	22.7	42.3	38.7	34.3
Factories, excluding hand and neighborhood industries:							
1899 (census of 1900)	207,514	8,975,256,000	4,712,763	2,008,361,000	6,575,851,000	11,406,927,000	4,831,076,000
1904 (census of 1905)	216,180	12,675,581,000	5,468,383	2,610,445,000	8,500,208,000	14,793,903,000	6,293,695,000
Per cent of increase, 1899 to 1904	4.2	41.2	16.0	30.0	29.3	29.7	30.3
1909 (census of 1910)	268,491	18,428,270,000	6,615,046	3,427,038,000	12,141,791,000	20,672,052,000	8,530,261,000
Per cent of increase, 1904 to 1909	24.2	45.4	21.0	31.3	42.8	39.7	35.5
Per cent of increase, 1899 to 1909	29.4	105.3	40.4	70.6	84.6	81.2	76.6

VARIATION OF WAGE EARNINGS OF THOSE EMPLOYED BY MONTHS.

Among the principal industries of the United States several show a great variation in the number of wage earners employed at various times of the year. The brick and tile industries employ an average of 76,528 wage earners during the year, the maximum number, 104,930, being employed in July, and the minimum number, 38,312, in January; the canning and preserving industries employ an average of 59,968 men, 154,800 being the maximum number in September, and 19,998 the minimum in January; the fertilizers employ an average of 18,310 men, the maximum number, 29,310, being reached in March, and the minimum number, 14,264, in July; oil, cottonseed, and cake industries employ an average of 17,071 men, the maximum number, 29,334 being reached in November, and the minimum, 5,174, in July; in the ice manufactories the average number of men employed was 16,114, the maximum number, 22,872, being reached in July, and the minimum, 9,847, in January; the artificial stone industries employed an average of 9,957 men, the maximum number, 12,884, being reached in August, and the minimum number, 4,856, in January; the straw and hats industries employed an average of 8,814 men, the maximum number of men employed being reached in March, when they employed 11,488 men, and the minimum number, 4,700, in July; in the sugar beet industries the average number of men employed was 16,807, the maximum number of employees, 16,807, being reached in November, and the minimum number, 2,206, in February; in the sugar and molasses industries the average number of employees was 4,127, the maximum number, 15,761, being reached in November, and the minimum, 559, in February; the vinegar and cider industries employed an average of 1,542 men, the maximum number, 3,464, being reached in October, and the minimum number, 886, being reached in March.

LEADING MANUFACTURING INDUSTRIES IN THE UNITED STATES 1909.

INDUSTRY.	Number of establishments.	WAGE EARNERS. Average number.	Rank.	Per cent distribution.	VALUE OF PRODUCTS. Amount (expressed in thousands).	Rank.	Per cent distribution.
All industries	**268,491**	**6,615,046**	....	**100.0**	**$20,672,052**	....	**100.0**
Slaughtering and meat packing	1,641	89,728	16	1.4	1,370,568	1	6.6
Foundry and machine-shop products	13,253	531,011	2	8.0	1,228,475	2	5.9
Lumber and timber products	40,671	695,019	1	10.5	1,156,129	3	5.6
Iron and steel, steel works and rolling mills	446	240,076	6	3.6	985,723	4	4.8
Flour-mill and gristmill products	11,691	39,453	30	0.6	883,584	5	4.3
Printing and publishing	31,445	258,434	5	3.9	737,876	6	3.6
Cotton goods, including cotton small wares	1,324	378,880	3	5.7	628,392	7	3.0
Clothing, men's, including shirts	6,354	239,696	7	3.6	568,077	8	2.7
Boots and shoes, including cut stock and findings	1,918	198,297	8	3.0	512,798	9	2.5
Woolen, worsted, and felt goods, and wool hats	985	168,722	9	2.6	435,979	10	2.1
Tobacco manufactures	15,822	166,810	10	2.5	416,695	11	2.0
Cars and general shop construction and repairs by steam-railroad companies	1,145	282,174	4	4.3	405,601	12	2.0
Bread and other bakery products	23,926	100,216	14	1.5	396,865	13	1.9
Iron and steel, blast furnaces	208	38,429	31	0.6	391,429	14	1.9
Clothing, women's	4,558	153,743	11	2.3	384,752	15	1.9
Smelting and refining, copper	38	15,628	38	0.2	378,806	16	1.8
Liquors, malt	1,414	54,579	25	0.8	374,730	17	1.8
Leather, tanned, curried, and finished	919	62,202	23	0.9	327,874	18	1.6
Sugar and molasses, not including beet sugar	233	13,526	41	0.2	279,249	19	1.4
Butter, cheese, and condensed milk	8,479	18,431	36	0.3	274,558	20	1.3
Paper and wood pulp	777	75,978	17	1.2	267,657	21	1.3
Automobiles, including bodies and parts	743	75,721	19	1.1	249,202	22	1.2
Furniture and refrigerators	3,155	128,452	13	1.9	239,887	23	1.2
Petroleum, refining	147	13,929	40	0.2	236,998	24	1.1
Electrical machinery, apparatus, and supplies	1,009	87,256	18	1.3	221,309	25	1.1
Liquors, distilled	613	6,430	43	0.1	204,699	26	1.0
Hosiery and knit goods	1,374	129,275	12	2.0	200,144	27	1.0
Copper, tin, and sheet-iron products	4,228	73,615	20	1.1	199,824	28	1.0
Silk and silk goods, including throwsters	852	99,037	15	1.5	196,912	29	1.0
Smelting and refining, lead	28	7,424	42	0.1	167,406	30	0.8
Gas, illuminating and heating	1,296	37,215	32	0.6	166,814	31	0.8
Carriages and wagons and materials	5,492	69,928	21	1.1	159,893	32	0.8
Canning and preserving	3,767	59,068	24	0.9	157,101	33	0.8
Brass and bronze products	1,021	40,618	29	0.6	149,989	34	0.7
Oil, cottonseed, and cake	817	17,071	37	0.3	147,868	35	0.7
Agricultural implements	640	50,551	26	0.8	146,329	36	0.7
Patent medicines and compounds and druggists' preparations	3,642	22,895	35	0.3	141,942	37	0.7
Confectionery	1,944	44,638	27	0.7	134,796	38	0.7
Paint and varnish	791	14,240	39	0.2	124,889	39	0.6
Cars, steam-railroad, not including operations of railroad companies	110	43,086	28	0.7	123,730	40	0.6
Chemicals	349	23,714	34	0.4	117,689	41	0.6
Marble and stone work	4,964	65,603	22	1.0	113,093	42	0.5
Leather goods	2,375	34,907	33	0.5	104,719	43	0.5
All other industries	61,887	1,648,441	....	24.9	4,561,002	....	22.0

SUMMARY OF INDUSTRIES, BY STATES AND WAGE EARNERS: 1909.

STATE.	Population.	Number of establishments.	WAGE EARNERS.			VALUE OF PRODUCTS.		
			Average number.	Rank.	Per cent distribution.	Amount (expressed in thousands).	Rank.	Per cent distribution.
United States	**91,972,266**	**268,491**	**6,615,046**	....	**100.0**	**$20,672,052**	....	**100.0**
New York	9,113,614	44,935	1,003,981	1	15.2	3,369,490	1	16.3
Pennsylvania	7,665,111	27,563	877,543	2	13.3	2,626,742	2	12.7
Illinois	5,638,591	18,026	465,764	4	7.0	1,919,277	3	9.3
Massachusetts	3,366,416	11,684	584,559	3	8.8	1,490,529	4	7.2
Ohio	4,767,121	15,138	446,934	5	6.8	1,437,936	5	7.0
New Jersey	2,537,167	8,817	326,223	6	4.9	1,145,529	6	5.5
Michigan	2,810,173	9,159	231,499	7	3.5	685,109	7	3.3
Wisconsin	2,333,860	9,721	182,583	10	2.8	590,306	8	2.9
Indiana	2,700,876	7,969	186,984	9	2.8	579,075	9	2.8
Missouri	3,293,335	8,375	152,993	11	2.3	574,111	10	2.8
California	2,377,549	7,659	115,296	13	1.7	529,761	11	2.6
Connecticut	1,114,756	4,251	210,792	8	3.2	490,272	12	2.4
Minnesota	2,075,708	5,561	84,767	18	1.3	409,420	13	2.0
Kansas	1,690,949	3,435	44,215	33	0.7	325,104	14	1.6
Maryland	1,295,346	4,837	107,921	15	1.6	315,669	15	1.5
Rhode Island	542,610	1,951	113,538	14	1.7	280,344	16	1.4
Texas	3,896,542	4,588	70,230	25	1.1	272,896	17	1.3
Iowa	2,224,771	5,528	61,635	29	0.9	259,238	18	1.2
Louisiana	1,656,388	2,516	76,165	21	1.2	223,949	19	1.1
Kentucky	2,289,905	4,776	65,400	27	1.0	223,754	20	1.1
Washington	1,141,990	3,674	69,120	26	1.0	220,746	21	1.1
Virginia	2,061,612	5,685	105,676	16	1.6	219,794	22	1.1
North Carolina	2,206,287	4,931	121,473	12	1.8	216,656	23	1.0
Georgia	2,609,121	4,792	104,588	17	1.6	202,863	24	1.0
Nebraska	1,192,214	2,500	24,336	37	0.4	199,019	25	1.0
Tennessee	2,184,789	4,609	73,840	22	1.1	180,217	26	0.9
Maine	742,371	3,546	79,955	19	1.2	176,029	27	0.8
New Hampshire	430,572	1,961	78,658	20	1.2	164,581	28	0.8
West Virginia	1,221,119	2,586	63,893	28	1.0	161,950	29	0.8
Alabama	2,138,093	3,398	72,148	24	1.1	145,962	30	0.7
Colorado	799,024	2,034	28,067	36	0.4	130,044	31	0.6
South Carolina	1,515,400	1,854	73,046	23	1.1	113,236	32	0.5
Oregon	672,765	2,246	28,750	35	0.4	93,005	33	0.4
Mississippi	1,797,114	2,598	50,384	31	0.8	80,555	34	0.4
Arkansas	1,574,449	2,925	44,982	32	0.7	74,916	35	0.4
Montana	376,053	677	11,655	41	0.2	73,272	36	0.4
Florida	752,619	2,159	57,473	30	0.9	72,890	37	0.4
Vermont	355,956	1,958	33,788	34	0.5	68,310	38	0.3
Utah	373,351	749	11,785	40	0.2	61,989	39	0.3
Oklahoma	1,657,155	2,310	13,143	39	0.2	53,682	40	0.3
Delaware	202,322	726	21,238	38	0.3	52,840	41	0.3
Arizona	204,354	311	6,441	44	0.1	50,257	42	0.2
District of Columbia	331,069	518	7,707	43	0.1	25,289	43	0.1
Idaho	325,594	725	8,220	42	0.1	22,400	44	0.1
North Dakota	577,056	752	2,789	48	(3)	19,138	45	0.1
South Dakota	583,888	1,020	3,602	46	0.1	17,870	46	0.1
Nevada	81,875	177	2,257	49	(2)	11,887	47	0.1
New Mexico	327,301	313	4,143	45	0.1	7,898	48	(2)
Wyoming	145,965	268	2,867	47	(2)	6,249	49	(2)

SUMMARY OF MANUFACTURES, BY PRINCIPAL CITIES BY RANK: 1909.

CITY.	Population.	Number of establishments.	WAGE EARNERS.		VALUE OF PRODUCTS.	
			Average number.	Rank.	Amount (expressed in thousands).	Rank.
New York, N. Y.	4,766,883	25,938	554,002	1	$2,029,693	1
Chicago, Ill.	2,185,283	9,656	293,977	2	1,281,171	2
Philadelphia, Pa.	1,549,008	8,379	251,884	3	746,076	3
St. Louis, Mo.	687,029	2,667	87,371	4	328,495	4
Cleveland, Ohio.	560,663	2,148	84,728	5	271,961	5
Detroit, Mich.	465,766	2,036	81,011	6	252,992	6
Pittsburgh, Pa.	533,905	1,659	67,474	9	243,454	7
Boston, Mass.	670,585	3,155	69,637	8	237,457	8
Buffalo, N. Y.	423,715	1,753	51,412	13	218,804	9
Milwaukee, Wis.	373,857	1,764	59,502	12	208,324	10
Newark, N. J.	347,469	1,858	59,955	11	202,511	11
Cincinnati, Ohio.	363,591	2,184	60,192	10	194,516	12
Baltimore, Md.	558,485	2,502	71,444	7	186,978	13
Minneapolis, Minn.	301,408	1,102	26,962	25	165,405	14
Kansas City, Kans.	82,331	165	12,294	42	164,081	15
San Francisco, Cal.	416,912	1,796	28,244	21	133,041	16
Jersey City, N. J.	267,779	745	25,454	28	128,775	17
Indianapolis, Ind.	233,650	855	31,815	19	126,522	18
Providence, R. I.	224,326	1,080	46,381	14	120,241	19
Rochester, N. Y.	218,149	1,203	39,108	15	112,676	20
Louisville, Ky.	223,928	903	27,023	24	101,284	21
South Omaha, Nebr.	26,259	71	6,306	48	92,436	22
Youngstown, Ohio.	79,066	115	10,498	45	81,271	23
Lawrence, Mass.	85,892	162	30,542	20	79,993	24
New Orleans, La.	339,075	848	17,186	37	78,794	25
Worcester, Mass.	145,986	580	28,221	22	77,148	26
Bayonne, N. J.	55,545	97	7,519	47	73,641	27
Akron, Ohio.	69,067	246	15,831	39	73,158	28
Perth Amboy, N. J.	32,121	80	5,866	50	73,093	29
Lynn, Mass.	89,336	431	27,368	23	71,503	30
Paterson, N. J.	125,600	702	32,004	18	69,584	31
Los Angeles, Cal.	319,198	1,325	17,327	36	68,586	32
Bridgeport, Conn.	102,054	367	25,775	27	65,609	33
Fall River, Mass.	119,295	288	37,139	16	64,146	34
Peoria, Ill.	66,950	283	5,981	49	63,061	35
Toledo, Ohio.	168,497	760	18,878	34	61,230	36
Omaha, Nebr.	124,096	432	8,023	46	60,854	37
Dayton, Ohio.	116,577	513	21,549	31	60,378	38
Lowell, Mass.	106,294	320	32,575	17	60,271	39
Yonkers, N. Y.	79,803	158	12,711	41	59,334	40
St. Paul, Minn.	214,744	719	19,339	33	58,990	41
Kansas City, Mo.	248,381	902	14,643	40	54,704	42
New Bedford, Mass.	96,652	207	26,566	26	53,238	43
Denver, Colo.	213,381	766	12,058	43	51,538	44
Reading, Pa.	96,071	482	24,145	29	51,135	45
New Haven, Conn.	133,605	590	23,547	30	51,071	46
Seattle, Wash.	237,194	751	11,331	44	50,569	47
Waterbury, Conn.	73,141	169	20,170	32	50,350	48
Syracuse, N. Y.	137,249	738	18,148	35	49,435	49
Camden, N. J.	94,538	365	16,527	38	49,138	50

OCCUPATIONS—STATUS BY LEADING INDUSTRIES, 1909.

INDUSTRY.	PERSONS ENGAGED IN MANUFACTURES.									
	Total number.	Proprietors and officials.				Clerks.	Wage earners (average number).	Per cent of total.		
		Total.	Proprietors and firm members.	Salaried officials of corporations.	Superintendents and managers.			Proprietors and officials.	Clerks.	Wage earners (average number).
All industries	**7,678,578**	**487,173**	**273,265**	**80,735**	**133,173**	**576,359**	**6,615,046**	**6.3**	**7.5**	**86.1**
Agricultural implements	60,229	2,489	465	569	1,455	7,189	50,551	4.1	11.9	83.9
Automobiles, including bodies and parts	85,359	2,564	405	758	1,401	7,074	75,721	3.0	8.3	88.7
Boots and shoes, including cut stock and findings	215,923	5,752	1,838	1,027	2,887	11,874	198,297	2.7	5.5	91.8
Brass and bronze products	45,441	2,160	828	584	748	2,663	40,618	4.8	5.9	89.4
Bread and other bakery products	144,322	29,136	26,982	801	1,353	14,970	100,216	20.2	10.4	69.4
Butter, cheese, and condensed milk	31,506	10,480	8,019	1,032	1,429	2,595	18,431	33.3	8.2	58.5
Canning and preserving	71,972	6,920	4,244	968	1,708	5,084	59,968	9.6	7.1	83.3
Carriages and wagons and materials	82,944	8,844	6,213	1,166	1,465	4,172	69,928	10.7	5.0	84.3
Cars and general shop construction and repairs by steam-railroad companies	301,273	6,974	2	1,877	5,095	12,125	282,174	2.3	4.0	93.7
Cars, steam-railroad, not including operations of railroad companies	47,094	1,041	7	241	793	2,967	43,086	2.2	6.3	91.5
Chemicals	27,791	1,086	154	367	565	2,991	23,714	3.9	10.8	85.3
Clothing, men's, including shirts	271,437	12,041	8,502	1,089	2,450	19,700	239,696	4.4	7.3	88.3
Clothing, women's	179,021	9,281	6,482	842	1,957	15,997	153,743	5.2	8.9	85.9
Confectionery	54,854	3,362	1,832	766	764	6,854	44,638	6.1	12.5	81.4
Copper, tin, and sheet-iron products	86,934	7,269	4,423	1,288	1,558	6,050	73,615	8.4	7.0	84.7
Cotton goods, including cotton small wares	387,771	4,461	377	1,726	2,358	4,430	378,880	1.2	1.1	97.7
Electrical machinery, apparatus, and supplies	105,600	4,121	439	997	2,685	14,223	87,256	3.9	13.5	82.6
Flour-mill and gristmill products	66,054	18,763	14,570	1,486	2,707	7,838	39,453	28.4	11.9	59.7
Foundry and machine-shop products	615,485	31,605	9,851	9,348	12,406	52,869	531,011	5.1	8.6	86.3
Furniture and refrigerators	144,140	7,281	2,657	2,170	2,454	8,407	128,452	5.1	5.8	89.1

THE DARWINIAN THEORY.

In 1859, Charles Darwin published a work entitled "Origin of Species," to prove that the numerous species now existing on the earth sprang originally from one or at most a few primal forms; and that the present diversity is due to special development and natural selection. Those plants and creatures which are best suited to the conditions of their existence survive and become fruitful; certain organs called into play by peculiar conditions of life grow with their growth and strengthen with their strength till they become so much a part and parcel of their frames as to be transmitted to their offspring. The conditions of life being very diverse, cause a great diversity of organic development, and, of course, every such diversity which has become radical is the parent of a new species.

OCCUPATIONS—STATUS BY LEADING INDUSTRIES—*Continued.*

INDUSTRY.	PERSONS ENGAGED IN MANUFACTURES.									
	Total number.	Proprietors and officials.				Clerks.	Wage earners (average number).	Per cent of total.		
		Total.	Proprietors and firm members.	Salaried officials of corporations.	Superintendents and managers.			Proprietors and officials.	Clerks.	Wage earners (average number).
Gas, illuminating and heating	51,007	2,986	277	990	1,719	10,806	37,215	5.9	21.2	73.0
Hosiery and knit goods	136,130	3,308	1,134	799	1,375	3,547	129,275	2.4	2.6	94.9
Iron and steel, blast furnaces	43,061	1,119	48	262	809	3,513	38,429	2.6	8.2	89.2
Iron and steel, steel works and rolling mills	260,762	4,286	47	779	3,460	16,400	240,076	1.6	6.3	92.1
Leather goods	43,525	4,209	2,552	760	897	4,409	34,907	9.7	10.1	80.2
Leather, tanned, curried, and finished	67,100	2,331	784	629	918	2,567	62,202	3.5	3.8	92.7
Liquors, distilled	8,328	1,111	563	217	331	787	6,430	13.3	9.4	77.2
Liquors, malt	66,725	4,362	639	1,819	1,904	7,784	54,579	6.5	11.7	81.8
Lumber and timber products	784,989	68,165	48,825	6,616	12,724	21,805	695,019	8.7	2.8	88.5
Marble and stone work	77,275	8,453	6,026	867	1,560	3,219	65,603	10.9	4.2	84.9
Oil, cottonseed, and cake	21,273	2,167	110	576	1,481	2,035	17,071	10.2	9.6	80.2
Paint and varnish	21,896	2,016	456	793	767	5,640	14,240	9.2	25.8	65.0
Paper and wood pulp	81,473	2,298	250	773	1,275	3,197	75,978	2.8	3.9	93.3
Patent medicines and compounds and druggists' preparations	41,101	5,647	2,802	1,427	1,418	12,559	22,895	13.7	30.6	55.7
Petroleum, refining	16,640	671	42	211	418	2,040	13,929	4.0	12.3	83.7
Printing and publishing	388,466	49,332	30,424	7,265	11,643	80,700	258,434	12.7	20.8	66.5
Silk and silk goods, including throwsters	105,238	2,236	664	480	1,092	3,965	99,037	2.1	3.8	94.1
Slaughtering and meat packing	108,716	3,514	1,659	731	1,124	15,474	89,728	3.2	14.2	82.5
Smelting and refining, copper	16,832	275	7	53	215	929	15,628	1.6	5.5	92.8
Smelting and refining, lead	8,059	132	.....	44	88	503	7,424	1.6	6.2	92.1
Sugar and molasses, not including beet sugar	15,658	789	204	140	445	1,343	13,526	5.0	8.6	86.4
Tobacco manufactures	197,637	21,012	17,634	809	2,569	9,815	166,810	10.6	5.0	84.4
Woolen, worsted, and felt goods, and wool hats	175,176	3,192	732	782	1,678	3,262	168,722	1.8	1.9	96.3
All other industries	1,916,361	117,932	59,096	23,811	35,025	149,988	1,648,441	6.2	7.8	86.0

THE BULK AND WEIGHT OF OUR RAINFALL.

To anyone who is familiar only with the customary method of stating rainfall, it is somewhat startling to learn, for instance that 43.9 cubic miles of rain fell in Missouri during the year 1896. This is decidedly more impressive than the statement that the rainfall was about 41 inches. In the same year 1296.4 cubic miles of water is computed to have fallen over the whole of the United States, and the average annual rainfall is somewhat greater than this; viz., 1,308 cubic miles, weighing 6,000,000,000,000 tons. As an illustration of the fact that most of the water that falls as rain never reaches the sea through the medium of drainage, but is evaporated from the land, it has been shown that the discharge of the Mississippi River at St. Louis is but little greater than the volume of rainfall over the State of Missouri alone, despite the enormous area drained by the river above that point.

DISTRIBUTION OF EXPENSES IN PERCENTAGES FOR THE LEADING INDUSTRIES 1909.

INDUSTRY.	PER CENT OF TOTAL EXPENSES REPORTED.			
	Salaries.	Wages.	Materials.	Miscellaneous expenses.
All industries	**5.1**	**18.6**	**65.8**	**10.5**
Agricultural implements	8.6	24.3	51.1	16.0
Automobiles, including bodies and parts	4.5	23.1	62.5	9.9
Boots and shoes, including cut stock and findings	3.9	20.6	69.6	5.9
Brass and bronze products	4.1	17.3	72.6	6.0
Bread and other bakery products	4.0	17.4	69.9	8.6
Butter, cheese, and condensed milk	1.4	4.3	91.0	3.3
Canning and preserving	5.6	13.5	72.0	9.0
Carriages and wagons and materials	5.7	27.0	58.9	8.4
Cars and general shop construction and repairs by steam-railroad companies	4.3	44.7	49.2	1.8
Cars, steam-railroad, not including operations of railroad companies	4.3	23.0	66.7	6.0
Chemicals	6.5	15.0	68.2	10.3
Clothing, men's, including shirts	5.2	20.7	57.9	16.2
Clothing, women's	6.0	23.0	61.1	9.9
Confectionery	7.6	13.1	67.9	11.4
Copper, tin, and sheet-iron products	5.8	22.4	63.7	8.1
Cotton goods, including cotton small wares	2.6	24.0	66.9	6.5
Electrical machinery, apparatus, and supplies	10.0	24.5	53.8	11.7
Flour-mill and gristmill products	1.5	2.6	92.8	3.1
Foundry and machine-shop products	8.7	29.8	50.1	11.4
Furniture and refrigerators	7.3	30.8	51.0	10.9
Gas, illuminating and heating	10.9	18.4	46.2	24.5
Hosiery and knit goods	4.4	25.5	62.7	7.4
Iron and steel, blast furnaces	1.8	6.8	88.4	3.0
Iron and steel, steel works and rolling mills	2.9	18.3	73.9	4.8
Leather goods	7.2	19.3	64.6	8.9
Leather, tanned, curried, and finished	2.2	10.5	81.2	6.1
Liquors, distilled	1.0	1.6	18.4	79.0
Liquors, malt	7.6	13.7	32.2	46.5
Lumber and timber products	4.8	32.0	51.0	12.2
Marble and stone work	6.7	44.8	39.4	9.1
Oil, cottonseed, and cake	3.1	4.3	87.7	4.9
Paint and varnish	9.3	7.4	71.1	12.2
Paper and wood pulp	4.0	17.2	69.7	9.1
Patent medicines and compounds and druggists' preparations	14.9	8.7	44.1	32.4
Petroleum, refining	1.8	4.4	89.6	4.2
Printing and publishing	16.7	26.6	32.6	24.1
Silk and silk goods, including throwsters	4.2	21.8	60.8	13.2
Slaughtering and meat packing	1.5	3.9	91.3	3.3
Smelting and refining, copper	0.7	3.8	94.4	1.1
Smelting and refining, lead	0.9	3.4	94.8	0.9
Sugar and molasses, not including beet sugar	0.9	2.8	92.6	3.7
Tobacco manufactures	4.6	19.0	48.4	28.0
Woolen, worsted, and felt goods, and wool hats	2.6	18.7	72.9	5.8
All other industries	6.4	21.1	62.1	10.5

I. ENGINES AND POWER.

In 1909 408,472 engines or motors, having a total horse-power of 18,680,776, used primary power in the United States. Of this number 209,163 were owned and 199,309 were rented. The owned engines or motors were divided according to power, as follows: Steam, 153,482 with total horse-power of 14,202,137; gas, 34,352, total horse-power 754,083; water wheels, 20,126, total horse-power 1,807,144; water motors, 1,203, total horse-power 15,449; all other owned engines or motors having a horse-power of 29,293. The rented engines were divided as follows: Electric, 199,309, total horse-power 1,749,031; all other rented engines or motors haing a total horse-power of 123,639. At the end of the year 1909 there were 388,854 electric motors in the United States, having a total horse-power of 4,817,140. Of these 189,545, having a horse-power of 3,068,109, were run by current generated by establishment; and 199,309, having a total horse-power of 1,749,031, were run by rented power. Our comparison would be even more spectacular if figures for the year 1912 could be obtained.

II. MANUFACTURED FOOD PRODUCTS.

Slaughtering and Meat Packing.

The total cost of all the material used in the slaughtering and meat-packing business during the year 1909, amounted to $1,201,827,784. The cost of all the animals slaughtered was $960,725,581. The total number of beeves killed was 8,114,860 and they were valued at $392,127,010; the total number of calves slaughtered was 2,504,728 and they were valued at $25,030,014; the number of sheep slaughtered was 12,255,501, and their value was $59,924,931; the number of hogs slaughtered amounted to 33,870,616 and their value was $483,383,848; the goats slaughtered numbered 33,224 and were valued at $121,230; and the cost of all other animals slaughtered was $138,548. The dressed meat purchased during the year 1909 was valued at $93,409,286, and all the other materials purchased at $147,692,917. The products of the slaughtering and meat packing business for the year were valued at $1,370,568,101 and were divided as follows: Beef, 4,335,674,330 pounds, value, $339,742,608; of which 4,209,196,668 pounds, valued at $327,583,456, were fresh, and 126,477,662 pounds valued at $12,159,152, were salted or dried; veal, 252,997,078 pounds, value, $25,058,886; fresh mutton, 495,457.894, value, $50,735,116; pork, 4,377,127,187, value, $486,845,161, of which 1,547,494,184 pounds, valued at $158,714,862, were fresh; 952,130,557 pounds, valued at $95,959,048, were salted; 789,861,744 pounds, valued at $101,089,390, were hams; 346,294,769 pounds, valued at $33,225,458, were shoulders; and 741,345,933 pounds, valued at $97,856,403, were bacons and sides; sausage, fresh or cured, value $59,564,582; all other fresh meat, 257,809,083 pounds, value, $16,392,768; canned goods, 121,376,837 pounds, value, $15,345,543; lard, 1,243,567,604 pounds, value, $134,396,587; tallow or oleo stock, 202,844,139 pounds, value, $13,499,659; oleo oil, 19,692,172 gallons, value, $16,475,726; other oils, 11,343,186 gallons, value, $6,350,745; oleomargarine, 42,912,466 pounds, value, $5,963,981; stearin, 54,957,997 pounds, value, $6,871,935; glue and gelatine, 27,936,035 pounds, value, $1,944,338; fertilizers and fertilizer materials, 362,136 tons, value, $8,726,818; hides, 9,560,138, value, $68,401,515; sheep pelts, 11,691,308, value, $11,404,556; goat and kid skins, 33,359, value, $20,679; wool, 21,858,926 pounds, value, $8,327,095; amount received for custom or contract work, $1,329,739; and all other products, value, $93,170,064.

Canning and Preserving.

At the end of the year 1909 there were 3,767 canning and preserving establishments in the United States, having a total capital of $119,207,000. The total cost of all materials used in the establishments was $101,823,000; the amount spent in these factories for wages was $19,082,000; the amount spent for salaries $7,864,000; and the miscellaneous expenses were $12,718,000. The total value of the products was $157,101,000, and the value added by manufacture (products less cost of materials) was $55,278,000. The total number of salaried officials and clerks employed in the establishments numbered 7,760; and the average number of wage earners employed during the year was 59,968. The primary horse-power of the establishments was 81,179.

There were 32,834,820 cases of vegetables, having a value of $51,568,914, canned during the year. The total value of the tomatoes canned during the year was $18,747,941; the value of the corn, $10,332,136; of peas, $10,247,363; of beans, $6,013,098; of asparagus, $1,975,775. There were 5,461,233 cases of fruits canned during the year 1909, and their total value was $12,938,474. The total value of the peaches canned during the year was $3,753,698; of the apples, $1,898,720; of the apricots, $1,825,311; of the pears, $1,833,214; of the berries, $1,743,026; of the cherries, $990,914. During the same year there were 484,328,767 pounds of fruits, with a total value of $21,914,995, dried in the United States. Of this total $6,912,533 represented the value of the raisins dried; $5,130,412 that of the prunes; $3,098,095 that of the apples; $2,423,083 that of the peaches; $2,277,177 that of the apricots.

During the year 1909 there were 235,418,713 pounds of fish and oysters, with a value of $17,573,311, canned in the United States. There were 99,831,528 pounds of salmon, with a value of $8,723,565, canned during the year; 90,694,284 pounds of sardines, with a value of $4,931,831; 28,192,392 pounds of oysters, with a value of $2,443,101. There were 39,814,989 pounds of fish, having a value of $2,900,417, smoked during the year 1909; and 128,539,299 pounds of fish, having a value of $7,174,561,

salted during the year. 49,494,338 pounds of cod, with a value of $3,077,612, were salted during this period; and 9,045,469 pounds of mackerel, with a value of $740,513.

Rice, Cleaning and Polishing.

In 1909 there were 974,747,475 pounds of rice treated, 970,873,740 of which were domestic and 3,873,735 of which were of foreign growth. The total value of the products derived therefrom amounted to $22,371,457. There were 626,089,489 pounds of rice, valued at $20,685,982, produced in the United States, 477,589,004 of which, valued at $17,398,736, were whole and 148,500,485 pounds of which, valued at $3,287, 246, were broken. There was 29,821,-813 pounds of polish, valued at $362,052, produced from rice during the year; 91,208,-529 pounds of bran, valued at $736,215; $166,147 worth of hulls and waste; and $421,061 worth of all other rice products.

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THE MEATS WE EAT.

FLOUR AND GRIST MILL PRODUCTS.

	1909	1904	1899
MATERIALS.			
Total cost	**$767,576,479**	**$619,971,161**	**$428,116,757**
Grain ground or milled, bushels	806,247,961	754,945,729	729,061,820
Wheat	496,480,314	494,095,083	471,306,986
Corn	209,281,237	178,217,321	180,573,076
Rye	11,503,969	11,480,370	10,088,381
Buckwheat	7,156,062	6,531,305	5,490,156
Barley	24,509,770	18,628,552	10,067,348
Oats	50,241,598	45,381,009	47,175,766
Other	7,075,011	612,089	4,360,107
PRODUCTS.			
Total value	[1] **$883,584,405**	[2] **$713,033,395**	**$501,396,304**
Wheat flour:			
Barrels	105,756,645	104,013,278	99,763,777
Value	$550,116,254	$480,258,514	$333,997,686
White—			
Barrels	105,321,969	103,608,350	[3]
Value	$548,017,654	$478,484,601	[3]
Graham—			
Barrels	434,676	404,928	[3]
Value	$2,098,600	$1,773,913	[3]
Rye flour:			
Barrels	1,532,139	1,503,100	1,443,339
Value	$6,383,538	$5,892,108	$4,145,565
Buckwheat flour:			
Pounds	176,081,891	175,354,062	143,190,724
Value	$4,663,561	$4,379,359	$3,190,152
Barley meal:			
Pounds	28,550,952	68,508,655	91,275,646
Value	$486,000	$922,884	$963,710
Corn meal and corn flour:			
Barrels	21,552,737	23,624,693	27,838,811
Value	$66,941,095	$56,368,556	$52,167,739
Hominy and grits:			
Pounds	827,987,702	756,861,398	291,726,145
Value	$12,509,493	$8,455,420	$2,567,084
Feed:			
Tons (2,000 pounds)	5,132,369	3,456,786	3,993,080
Value	$140,541,915	$76,096,127	$63,011,421
Offal:			
Tons (2,000 pounds)	4,104,042	4,468,626	3,164,408
Value	$89,814,427	$76,105,532	$36,679,196
All other cereal products—"breakfast foods," oatmeal, rolled oats, etc., value	$4,720,106	[3]	[3]
All other products, value	$7,408,016	$4,554,895	$4,673,751
EQUIPMENT.			
Pairs of rolls	76,866	80,822	67,141
Runs of stone	11,185	10,609	10,939
Attrition mills	981	[4]	[4]

[1] In addition, merchant-ground products, valued at $1,637,228, were made by establishments engaged primarily in the manufacture of products other than those covered by the industry designation. The items covered by this amount were wheat flour, 105,477 barrels, valued at $614,952; corn meal, 32,804 barrels, valued at $87,507; rye flour, 2,620 barrels, valued at $12,330; feed, 33,765 tons, valued at $907,165; and offal, 627 tons, valued at $15,274; and in addition, "breakfast foods," to the value of $36,978,613, were made by establishments engaged primarily in the manufacture of food preparations. See note to table on page 73, for custom ground by-products.

[2] In addition, "breakfast foods," to the value of $23,904,952, were made by establishments engaged primarily in the manufacture of food preparations.

[3] Not reported separately.

[4] Not reported.

SUGAR.

The total acreage of sugar beets planted in the United States amounted to 415,964. Of these 29,459 were planted directly by the factory; 18,166 by tenants of the factory; 368,339 on contract by others than tenants of the factory. There were 3,965,356 tons of beets used in the industry. Of these 266,768 were grown directly by the factory; 163,843 tons by tenants of the factory; and 3,534,745 tons on contract by others than the tenants of the factory. The total value of the products derived from the beets was $48,122,383. Of this 496,807 tons of granulated sugar were valued at $45,645,810; 4,875 tons of raw sugar were valued at $291,819; 20,812,747 gallons of molasses or syrup were valued at $1,129,905; beet pulp was valued at $795,900; and all other products were valued at $258,949.

The total value of all the sugar produced in the United States during the year 1909 was $77,991,683, and of this $48,122,383 was derived from the sugar-beet industry, and $29,869,300 from the cane-sugar industry. There were 828,540 tons of sugar produced, the total value of which was $72,033,302, of which amount 501,862 pounds, valued at $45,937,629, were beet sugar, and 326,858 pounds, valued at $26,095,673, were cane sugar. The total value of molasses, syrup, and all other products produced of either cane or beet was $5,958,381.

III. TEXTILES.

Rugs and Carpets.

During the year 1909 there were 57,176,729 square yards of carpets, with a value of $48,475,889, manufactured in the United States. During the same period there were 24,042,152 square yards of rugs, valued at $18,490,449, woven in the United States.

Cordage and Twine and Jute and Linen Goods.

The total value of the cordage and twine and jute and linen goods produced in the United States during the year 1909 was $61,019,986. The total value of the rope and binder twine for the same year was $33,930,306; of the twine not including binder, $8,934,352; of the yarns for sale, $5,434,037; of the 6,530,503 pounds of linen thread used, $3,407,008; of the 69,311,288 square yards of gunny-bagging, $3,507,482; and of the 2,206,114 square yards of jute carpets and rugs, $549,221.

Felt Goods.

The aggregate cost of the material required in the production of the felt goods of the United States during the year 1909 was $6,967,206, and the total value of these products for the same period was $11,852,626. There were 3,764,468 square yards of felt cloths, valued at $1,381,854, produced in that year.

Hats, Fur-Felt and Wool-Felt.

The value of the 2,989,252 dozens of fur-felt hats produced during the year 1909 was $43,442,466, and the value of the 366,370 dozen of fur-felt hat bodies and hats in the rough for the same period was $2,703,738.

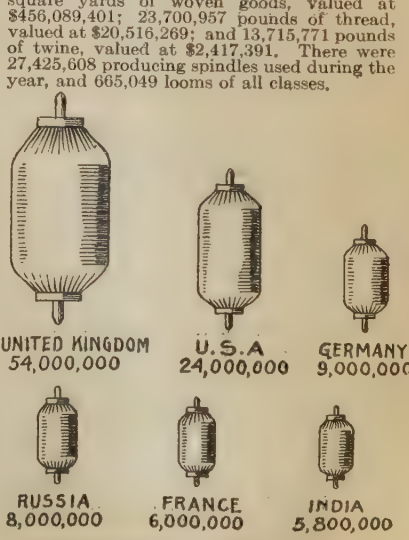
The total value of the 590,957 dozen wool-felt hats produced in the United States during the year 1909 was $3,646,787.

Hosiery and Knit Goods.

There were, during the year 1909, 62,825,069 dozen pair of hosiery produced in the United States and they were valued at $68,721,825. During the same period there were 25,337,779 dozen shirts and drawers produced, with a total value of $69,592,817; 2,473,103 dozen combinations, with a value of $14,853,536; sweaters, cardigan jackets, etc., to the value of $22,430,817; and gloves and mittens to the value of $7,296,887. In the production of the hosiery and knit goods of the United States there were 2,681 sets of cards used; 736,774 spindles; 112,206 knitting machines of all classes, and 43,885 sewing machines of all classes.

Cotton Goods.

The total cost of the 2,335,344,906 pounds of cotton material consumed in the production of cotton goods during the year 1909 was $274,724,210. The total value of the cotton goods produced from these materials was $628,391,813, divided as follows: 6,348,568,593 square yards of woven goods, valued at $456,089,401; 23,700,957 pounds of thread, valued at $20,516,269; and 13,715,771 pounds of twine, valued at $2,417,391. There were 27,425,608 producing spindles used during the year, and 665,049 looms of all classes.



CHIEF MANUFACTURING COUNTRIES.
(Number of Spindles).

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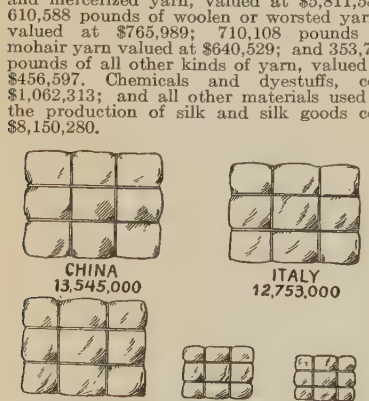
THE MAGNITUDE OF THE COTTON INDUSTRY, FROM COTTON BOLL TO FINISHED PRODUCT.

Oilcloth and Linoleum.

The total value of the oilcloth and linoleum produced in the United States during the year 1909 was $26,253,796. The oilcloth, valued at $11,681,012, was divided as follows: 18,354,851 square yards of floor oilcloth, valued at $3,776,660; 17,338,440 square yards of enameled oilcloth, valued at $2,265,146; 61,168,777 square yards of table oilcloth, valued at $5,639,206. The total value of the linoleum produced in the United States during the same period was $10,844,928. The value of the artificial leather produced in the United States during the same period was $3,448,617.

Silk and Silk Goods.

The total cost of the materials used in the production of the silk products of the United States was $107,766,916. There were 17,472,204 pounds of raw silk, valued at $67,787,037, required; 2,212,972 pounds of spun silk, valued at $4,848,789, used; 914,494 pounds of artificial silk, valued at $1,926,894; 3,377,972 pounds of organzine and tram, valued at $14,679,719, purchased; $1,637,187 dollars worth of fringe and floss, including waste, noils, etc.; 14,111,878 pounds of cotton and mercerized yarn, valued at $5,811,582; 610,588 pounds of woolen or worsted yarns, valued at $765,989; 710,108 pounds of mohair yarn valued at $640,529; and 353,780 pounds of all other kinds of yarn, valued at $456,597. Chemicals and dyestuffs, cost $1,062,313; and all other materials used in the production of silk and silk goods cost $8,150,280.



SILK.
A YEAR'S PRODUCTION.

The products of the silk and silk goods industry in the United States during the year 1909 were valued at $106,911,667. Of this amount $107,881,146 were derived from the manufacture of 185,707,316 yards of broad silk, as follows: $53,282,704 from the manufacture of 81,934,158 yards of all silk, plain and fancies; $14,207,861 from the 24,742,556 yards of silk mixed, plain and fancies; $9,835,345 from the 13,249,090 yards of all silk jacquard; $3,473,799 from the 6,043,686 yards of silk mixed jacquard; $11,353,242 from the 19,693,393 yards of all piece-dyed broad silk, and $15,728,195 from the 40,044,433 yards of mixed piece-dyed broad silk; $4,767,990 from the 10,093,583 yards of velvet; $2,104,768 from the 2,759,411 yards of plushes; $382,820 from the 226,717 yards of tapestries and upholstery; $32,744,873 from ribbons; $1,350,850 laces, nets, veils, veiling, etc.; $485,322 from embroideries; $824,527 from fringes and gimps; $4,483,248 from braids and bindings; $3,850,448 from trimmings; $6,341,719 from the 1,088,780 pounds of machinist twine; $4,179,355 from the 747,246 pounds of sewing, embroidery, wash, fringe and floss silks; $12,550,510 from the 2,740,319 pounds of organzine and tram; and $2,104,066 from the 779,462 pounds of spun silk. The value of all other products of the silk and silk goods industries amounted to $4,495,675; and the value of all the work done on materials for others amounted to $8,364,350.

Woolen and Worsted Goods.

The total cost of all the materials required in the manufacture of all the woolen and worsted goods produced in the United States during the year 1909 amounted to $273,438,570. This amount was divided as follows: 474,755,366 pounds of wool in the condition purchased, value $136,666,917, of which 310,602,279 pounds were domestic wool, with a value of $85,018,238, and 164,153,087 pounds were foreign wool, with a value of $51,648,679; mohair, camel, alpaca and vicuna hair, 7,805,422 pounds, value $2,399,123; cow and other animal hair, 17,356,100 pounds, value $932,911; cotton, 20,024,061 pounds, value $2,515,409; tailors' clippings, rags, etc., 40,402,460 pounds, value $2,856,966; shoddy, mungo and wool extract purchased, 21,454,187 pounds, value $3,058,214; waste and noils of wool, mohair, camel hair, etc., purchased, 26,473,311 pounds, value $7,523,283; tops purchased, 20,828,245 pounds, value $14,614,527; woolen yarns purchased, 931,222 pounds, value $558,270; worsted yarns purchased, 59,148,771 pounds, value $56,033,701; merino yarns purchased, 1,971,709 pounds, value $318,456; cotton yarns purchased, 39,169,388 pounds, value $10,492,185; silk and spun silk yarns, 282,536 pounds, value $1,142,663; all other yarns, 1,046,735 pounds, value $40,739; chemicals and dyestuffs, value $8,820,928; and all other materials, value $25,464,278.

The total value of all the products of the woolen and worsted goods manufactories was $419,743,521. This amount was derived from the following products: All-wool woven goods, 322,944,365 square yards, value $219,853,767; wool cloths, doeskins, cassimeres, cheviots, etc., 40,843,979 square yards, value $29,291,059; worsted coatings, serges and suitings, 119,655,069 square yards, value $101,903,153; woolen overcoatings, 14,697,770 square yards, value $11,230,856; worsted overcoatings and cloakings, 654,404 square yards, value $821,688; wool dress goods, sackings, tricots, etc., and opera and similar flannels, 29,099,956 square yards, value $16,385,498; worsted dress goods, cashmeres, serges, bunting, etc., 105,801,349 square yards, value $54,030,376; carriage cloths, 1,782,855 square yards, value $947,862; flannels for underwear, 3,856,553

square yards, value $1,257,271; blankets, 5,137,903 square yards, value $3,228,797; horse blankets, 247,395 square yards, value $185,430; woven shawls, 704,153 square yards, value $404,583; and all other all-wool woven goods, 463,179 square yards, value $167,194; union, or cotton mixed, woven goods, 37,453,351 square yards, value $14,327,973; unions, tweeds, cheviots, cassimeres, etc., 18,917,478 square yards, value $7,780,854; overcoatings and cloakings, 4,281,739 square yards, value $2,363,381; sackings, tricots, dress goods and opera and similar flannels, 4,319,539 square yards, value $1,776,721; flannels for underwear, 7,063,572 square yards, value $1,308,369; blankets, 1,717,758 square yards, value $650,714; all other union, or cotton mixed, woven goods, 1,153,265 square yards, value $447,934; all cotton-warp woven goods, 210,346,081 square yards, value $62,265,854; all upholstering goods and sundries, value $1,986,330; all partially manufactured products for sale, value $115,032,285; all other products, value $3,250,857. During the year there were 4,287,640 spindles, producing and doubling and twisting; also, 72,532 looms, all classes.

IV. IRON AND STEEL MANUFACTURES.

	1909
MATERIALS.	
Total cost	**$320,637,889**
Iron ore:	
Tons	48,353,677
Cost	$187,264,601
Domestic—	
Tons	46,605,930
Cost	$177,589,789
Foreign—	
Tons	1,747,747
Cost	$9,674,812
Mill cinder, scrap, etc.:	
Tons	1,982,530
Cost	$5,544,859
Fluxes:	
Tons	13,570,845
Cost	$12,239,493
Fuel, total cost [2]	$105,994,112
Coke—	
Tons (2,000 pounds)	31,436,536
Cost	$102,134,423
Charcoal—	
Bushels	38,032,618
Cost	$2,787,026
Anthracite coal [2]—	
Tons	265,401
Cost	$904,102
Bituminous coal [2]—	
Tons	102,833
Cost	$168,561
All other materials, cost	$9,594,824
PRODUCTS.	
Total value	**$391,429,283**
Pig iron:	
Tons	25,651,798
Value	$387,830,443
All other products, value	$3,598,840
Pig iron, classified according to fuel used:	
Bituminous, chiefly coke—	
Tons	[3] 24,608,572
Value	$369,684,636
Anthracite coal and coke mixed and anthracite alone—	
Tons	670,991
Value	$10,962,150
Charcoal—	
Tons	372,235
Value	$7,183,657
Pig iron, classified according to disposition:	
Produced for consumption in works of company reporting—	
Tons	15,858,203
Value	$239,387,017

	1909
PRODUCTS—continued.	
Pig iron, classified according to disposition—Continued.	
Produced for sale—	
Tons	9,793,595
Value	$148,443,426
Pig iron, classified by grades (tons):	
Bessemer, (0.04 to 0.10 per cent in phosphorus)	10,147,052
Low phosphorus (below 0.04 per cent in phosphorus)	248,720
Basic	7,741,759
Foundry	5,539,410
Forge or mill	586,685
Malleable Bessemer	934,211
White, mottled, and miscellaneous	110,810
Direct castings	16,181
Ferro alloys	326,970
Spiegeleisen	142,223
Ferromanganese	82,208
Ferrosilicon, including Bessemer ferrosilicon (7 per cent or over in silicon) and ferrophosphorus	102,539
Pig iron, classified by method of delivery or casting (tons):	
Delivered in molten condition	12,197,686
Sand cast	7,655,568
Machine cast	5,096,797
Chill cast	685,566
Direct castings	16,181
EQUIPMENT.	
Furnaces in active establishments:	
Completed stacks at end of year—	
Number	388
Daily capacity, tons	101,447
Active during the year—	
Number	370
Daily capacity, tons	98,973
In course of construction at end of year—	
Number	10
Daily capacity, tons	4,100
Pig-casting machines, number	104
Granulated slag pits:	
Number	85
Annual capacity, tons	5,699,259
Gas engines operated with blast-furnace gas:	
Number	85
Horsepower	198,040

IRON AND STEEL.

	1909
I. MATERIALS.	
Total cost	**$657,500,856**
Iron and steel:[1]	
For furnaces and hot rolls—	
Tons	30,388,755
Cost	$515,769,588
Pig iron and ferroalloys—	
Tons	19,076,889
Cost	$297,471,122
Pig iron—	
Tons	18,712,304
Cost	$282,663,740
Ferroalloys—spiegeleisen, ferromanganese, etc.—	
Tons	364,585
Cost	$14,807,382
Scrap, including old rails not intended for rerolling—	
Tons	4,803,617
Cost	$72,722,831
Ingots, blooms, billets, slabs, muck and scrap bar, rerolling rails, and sheet and tin-plate bars—	
Tons	6,508,249
Cost	$145,575,635
Rolled forms for further manufacture—	
Skelp—	
Tons	176,717
Cost	$5,704,856
Wire rods—	
Tons	146,425
Cost	$4,252,695
Iron ore:	
Tons	835,338
Cost	$4,292,963
All other materials, cost	$127,480,754
II. PRODUCTS.	
Total value	**$985,722,534**
Rolled, forged, and other classified products, steel and iron:	
Tons	26,723,274
Value	$863,342,711
Rails—	
Tons	2,858,599
Value	$81,128,295
Bessemer steel—	
Tons	1,643,527
Value	$44,727,515
Open-hearth steel, basic—	
Tons	1,215,072
Value	$36,400,780
Rerolled or renewed rails—	
Tons	106,352
Value	$2,683,017
Rail fastenings (splice bars, tie-plates, fishplates, etc.)—	
Tons	396,911
Value	$14,488,412
Structural shapes, not including plates used for making girders—	
Tons	2,123,630
Value	$65,564,593
Steel—	
Tons	2,102,300
Value	$64,853,466
Open-hearth—	
Tons	1,934,230
Value	$59,789,948
Bessemer—	
Tons	168,070
Value	$5,063,518

	1909
II. PRODUCTS—continued.	
Iron—	
Tons	21,330
Value	$711,127
Bars and rods, including merchant, shovel, finger, and horseshoe bars, spike, chain, bolt, and nut rods, etc. (but not including wire rods, sheet and tin-plate bars, splice bars, and bars for reenforced concrete):	
Tons	3,784,248
Value	$121,488,423
Bars for reenforced concrete:	
Tons	191,358
Value	$5,588,963
Wire rods:	
Tons	2,295,279
Value	$61,947,958
Plates and sheets, not including black plates or sheets for tinning, nail and tack plates, tie-plates, fishplates, or armor plates:	
Tons	3,332,733
Value	$133,272,393
Black plates, or sheets, for tinning:	
Tons	631,435
Value	$30,955,967
Skelp, flue and pipe:	
Tons	2,084,286
Value	$64,514,728
Hoops, bands, and cotton ties:	
Tons	341,043
Value	$10,429,681
Nail and tack plates:	
Tons	68,557
Value	$2,540,022
Axles, car, locomotive, automobile, wagon, carriage, etc., rolled or forged:	
Tons	102,348
Value	$3,831,344
Armor plates, gun forgings, and ordnance:	
Tons	26,845
Value	$10,649,079
Blooms, billets, and slabs, produced for sale or for transfer to other works of same company:	
Tons	4,887,796
Value	$108,514,747
Rolled forging blooms and billets produced for sale or for transfer to other works of same company:	
Tons	84,383
Value	$2,247,133
Sheet and tin-plate bars produced for sale or for transfer to other works of same company:	
Tons	1,652,761
Value	$37,745,269
Muck and scrap bar produced for sale or for transfer to other works of same company:	
Tons	174,496
Value	$4,986,211
All other rolled steel or iron:	
Tons	566,627
Value	$39,570,061

IRON AND STEEL—Continued.

	1909
II. PRODUCTS—continued.	
Rolled, forged, and other classified products, steel and iron—Continued.	
Ingots produced for sale or for transfer to other works of same company:	
Tons	142,745
Value	$3,593,726
Direct steel castings:	
Tons	504,856
Value	$38,862,448
All other forged steel and iron, not including remanufactures of rolling-mill products:	
Tons	365,986
Value	$18,740,241
All other products, value	$122,379,823
Miscellaneous steel and iron products not rolled, including value added to iron and steel rolling-mill products by further manufacture, value	$86,534,369
Scrap steel or iron produced for sale or for transfer to other works of same company:	
Tons	1,238,554
Value	$18,163,624
All products other than steel and iron, value	$17,681,830
III. STEEL.	
Total production:	
Tons	[6] 23,473,718
Value (included above)	$478,736,988
Classified according to process:	
Open-hearth—	
Tons	14,176,054
Value	$292,360,129
Basic—	
Tons	13,210,419
Value	$262,529,822
Acid—	
Tons	965,635
Value	$29,830,307
Bessemer—	
Tons	9,190,291
Value	$178,232,848
Crucible and miscellaneous—	
Tons	107,373
Value	$8,144,011
Classified according to form:	
Ingots—	
Tons	22,968,862
Value	$439,874,540
Castings—	
Tons	504,856
Value	$38,862,448
Duplex process—open-hearth steel partly purified in Bessemer converters before finishing in open-hearth furnaces (included above), tons	522,682
Alloyed steels, nickel, tungsten, titanium, chrome, vanadium, etc. (included above), tons	158,216
Classified according to process:	
Open-hearth	100,335
Basic	86,242
Acid	14,093
Bessemer	45,324
Crucible and miscellaneous	12,557
Classified according to form:	
Ingots	151,300
Castings	6,916

	1909
IV. MANUFACTURES FROM ROLLING-MILL PRODUCTS.	
(Made in mill producing, value previously included.)	
Wire and wire products:	
Tons (2,000 pounds)	1,634,855
Value	$71,624,024
Pipes and tubes:	
Wrought welded—	
Tons	1,314,771
Value	$68,471,573
Seamless, hot-rolled or drawn—	
Tons	54,273
Value	$5,650,739
All other, including clinched, riveted, etc., but not including cast:	
Tons	17,561
Value	$986,699
Bolts, nuts, rivets, forged spikes, washers, etc.:	
Kegs (200 pounds)	4,471,985
Value	$20,538,858
Cut nails and spikes:	
Kegs (100 pounds)	1,009,319
Value	$2,218,207
Horse and mule shoes:	
Kegs (200 pounds)	996,383
Value	$7,202,897
Springs, car, furniture, and all other, not including wire springs:	
Tons	6,191
Value	$374,924
Switches, frogs, crossings, etc.:	
Tons	28,608
Value	$2,471,008
Galvanized plates or sheets:	
Tons	431,658
Value	$25,912,056
Stamped ware:	
Tons	24,612
Value	$2,296,707
Shovels, spades, scoops, etc., value	$540,321
V. PRODUCTS SOLD FOR EXPORT.	
(By establishments producing.)	
Total tons	867,646
Rails	317,455
Rail fastenings	20,118
Pipes and tubes	89,377
Sheet and tin-plate bars	85,123
Plates and sheets	80,706
Galvanized plates or sheets	79,246
Structural shapes	69,764
Bars and rods	48,938
Wire rods	18,738
Blooms, billets, and slabs	18,021
Skelp	10,703
Miscellaneous	29,457
VI. EQUIPMENT.	
Steel plants: Daily capacity of steel furnaces and converters, tons of steel, double turn	108,716
Open-hearth furnaces—	
Number	687
Daily capacity, tons of steel, double turn	61,601
Basic—	
Number	549
Daily capacity, tons of steel, double turn	55,273
Acid—	
Number	138
Daily capacity, tons of steel, double turn	6,328

IRON AND STEEL—Continued.

	1909
VI. EQUIPMENT.—continued.	
Converters, Bessemer or modified Bessemer—	
Number	99
Daily capacity, tons of steel, double turn	45,983
Crucible furnaces—	
Number	257
Number of pots that can be used at a heat	3,840
Daily capacity, tons of steel, double turn	840
All other steel furnaces—	
Number	16
Daily capacity, tons of steel, double turn	292
Metal mixers—	
Number	59
Capacity, tons	14,343
Rolling mills: Daily capacity of rolled steel and iron, double turn, tons	150,403

Production of Coke.

The total cost of the materials used in the production of coke, was $65,388,124. The cost of the coal charged into ovens, was $59,354,937. The total value of the coke produced, was $98,078,383; 39,315,065 tons were valued at $89,965,483. Among by-products obtained in the manufacture of coke was gas, which measured in thousands of cubic feet, amounted to 76,590,763 of which 60,799,543 cubic feet (thousands) were used in process or wasted and 15,791,220 cubic feet (thousands) were sold at a value of $2,609,211. 60,126,006 gallons of tar were obtained having a value of $1,408,611; of sulphate ammonia, or its equivalent in sulphate, 123,111,197, valued at $3,227,316. At the end of the year 1909, the number of ovens in use in the United States was 103,982. 201 had been abandoned during the year, and 2,950 were building.

Coal seems to have been used for fuel by the ancient Britons, but the first proper notice we have is that it was mined in Newcastle 1233.

AGRICULTURAL IMPLEMENTS.

PRODUCT.	1909
Total value	**$146,329,268**
Implements of cultivation	$35,246,030
Seeders and planters	$13,679,921
Harvesting implements	$34,568,131
Seed separators	$11,030,412
All other products	$48,690,082
Amount received for repair work	$3,114,692
Principal kind of implements, by number.	
Implements of cultivation:	
Cultivators—	
Beet	3,172
Small	469,696
Wheeled	435,429
Cotton scrapers	20,180
Harrows—	
Disk	193,000
Spring-tooth	112,832
Spike-tooth	394,988
Listers	44,840
Plows—	
Disk	22,132
Gang	91,686
Shovel	254,737
Steam	2,355
Sulky or wheel	134,936
Walking	1,110,006
Seeders and planters:	
Seeders—	
Broadcast	38,007
Combination	23,963
Corn planters—	
Hand	96,465
Horse	122,780
Cotton planters	79,271
Potato planters	23,092
Drills— continued.	
Corn	20,137
Disk	21,292
Grain	68,611
All other	32,507
Seed sowers	7,847
Harvesting implements:	
Grain cradles	22,635
Harvesters—	
Bean	1,409
Corn	19,693
Grain	129,274
Harvesters and thrashers combined	543
Other	1,707
Hay carriers	45,064
Hayforks, horse	43,675
Hay loaders	34,705
Hayrakes, horse	266,260
Haystackers	17,212
Hay tedders	34,396
Mowers	359,264
Potato diggers, horse	25,632
Reapers	58,294
Seed separators:	
Clover hullers	437
Corn huskers	372
Corn huskers and shredders	1,240
Corn shellers—	
Hand	74,223
Power	9,049
Fanning mills	33,805
Thrashers—	
Horsepower	822
Steam power	23,586

The total cost of the materials used in the manufacture of Glucose and Starch was $36,898,771. The total value of the manufactured products was $48,799,311; 677,535,647 pounds of starch were valued at $17,514,823; 769,660,210 pounds of glucose, including all sirups, valued at $17,922,514; 159,060,478 pounds grape sugar, valued at $3,620,816; 8,164,175 gallons corn oil, valued at $2,802,763.

TIN AND TERNE PLATE.

	1909
MATERIALS.	
Total cost	**$41,889,434**
Black plates or sheets:	
Pounds	[1] 1,321,071,691
Cost	$28,981,151
Produced by the establishment reporting:	
Pounds	1,291,048,109
Cost	$28,245,234
Purchased:	
Pounds	30,023,582
Cost	$735,917
Coating metals:	
Pounds	40,927,759
Cost	$9,670,037
Tin, including tin contents of terne mixture purchased—	
Pounds	31,077,651
Cost	$9,235,718
Lead, including lead contents of terne mixture purchased—	
Pounds	9,850,108
Cost	$434,319
In condition purchased—	
Pig tin—	
Pounds	28,586,267
Cost	$8,490,794
Pig lead—	
Pounds	2,708,496
Cost	$117,656
Terne mixture—	
Pounds	9,632,996
Cost	$1,061,587
All other materials, cost	$3,238,246
PRODUCTS.	
Total value	[1] **$47,969,645**
Tin and terne plates:	
Pounds	1,315,313,132
Value	$45,815,146
PRODUCTS—continued.	
Tin plates—	
Pounds	1,123,968,875
Value	$38,259,885
Terne plates—	
Pounds	191,344,257
Value	$7,555,261
Other sheet iron or sheet steel tinned or terne-plated, taggers tin, etc.:	
Pounds	19,400,934
Value	$520,465
All other products, value	$1,634,034
EQUIPMENT.	
Tin or terne sets at end of year:	
Completed—	
Number	563
Usually employed on tin plates	450
Usually employed on terne plates	113
Daily capacity, single turn, pounds	2,795,972
Tin plates	2,055,915
Terne plates	740,057
Daily capacity as operated, whether on single, double, or triple turn, pounds	7,016,293
Building, number	49
Black-plate department of establishments making their black plates:	
Hot black-plate mills at end of year—	
Completed—	
Number	335
Annual capacity on triple turn, long tons	1,042,088
Building—	
Number	20
Annual capacity on triple turn, long tons	36,600
Cold mills, completed, number	268

WIRE.

The value of the metal used in the production of wire, amounted to $115,655,427, while the total value of the products was $180,083,522. There were produced 2,471,854 tons of steel and iron wire, having a value of $120,585,637. There were also produced 13,926,861 kegs of wire nails and spikes, allowing 100 pounds to each keg, the total value being $27,575,774. There were also produced 28,125 tons of wire brads, tacks and staples, having a value of $1,324,170. The quantity of barbed wire manufactured was 323,565 tons, valued at $13,881,517; woven wire, fencing, and poultry netting, had a tonnage of 422,127, valued at $21,419,170; wire rope and strands had a tonnage of 45,303, the value being $6,683,771; other manufactures of iron and steel wire, such as springs, bale ties, flat wire, etc., weighed 129,940 tons, and cost $10,856,154.

There were produced in the United States in 1909, 154,231 tons of copper wire, valued at $47,184,164. The equipment consisted of 43,697 wire drawing blocks, having an annual capacity of 3,213,574 tons; 4,428 wire nail machines, having an annual capacity of 18,756,995 kegs of 100 pounds each. There were 446 woven-wire fence machines, having an annual capacity, in tons, of 480,373.

The total value of the steel and iron wire products, 1909, was $120,585,637; the wire mills were valued at $47,994,204; the wire departments of rolling mills produced 1,649,929 tons, valued at $72,651,433.

PRODUCTION OF SOAP.

The total cost of the materials used in the manufacture of this product in the United States in 1909 was $72,179,418. Of tallow, grease, and other fats, 413,969,787 pounds were consumed, costing $23,341,905; 11,856,837 gallons of cocoanut and palm-kernel oil, costing $5,875,294; 24,221,712 gallons cottonseed oil, costing $9,718,988; 207,296,447 pounds of rosin, costing $4,362,412; 94,050,892 pounds hoofs, costing $2,453,609; 52,172 tons (2,000 pounds) caustic soda, costing $2,212,232; 121,016 tons (2,000 pounds) soda ash, costing $2,281,787.

The total value of the soap products of the United States in 1909 was $111,357,777. 1,736,740,466 pounds of hard soap were made, valued at $88,550,830; 44,052,615 pounds of soft soap, valued at $943,676; 45,286,819 pounds of glycerin, valued at $5,713,558.

V. TRANSPORTATION.

Railroad Cars.

The total value of all railroad cars constructed in all establishments throughout the United States, in 1909, was $102,137,396. The value of the steam-railroad cars was $94,874,287: Of these for passenger service were built 1,819 cars, valued at $15,120,961; for freight service, 96,648 cars, valued at $79,753,326. Of street-railroad cars, which were chiefly electric, there were built 2,772 cars, valued at $7,263,109.

Steam-Railroad Cars.

The total value of the products of this industry in the United States, in 1909, was $123,729,627. Of steam-railroad cars for the passenger service there were constructed 1,601 cars, valued at $13,829,607: of this class there were built 216 baggage and express cars, valued at $1,105,779; 95 mail cars, valued at $600,912; 957 passenger cars, valued at $7,209,425; the chair, dining and buffet, parlor, sleeping, and all other cars, amounted to 333, valued at $4,913,491. For the freight service the number of cars constructed, totaled 73,177, valued at $61,691,825; Of these there were 29,728 box cars, valued at $23,982,446; 11,473 coal and coke, valued at $9,419,655; 3,232 flat cars, valued at $2,033,801; 900 fruit cars, valued at $784,476; 90 furniture cars, valued at $70,515; 19,607 gondola or ore, valued at $18,128,186: 2,618 refrigerator cars, valued at $2,747,957; 2,349 stock cars, valued at $1,586,008; 537 caboose, valued at $525,605; 2,643 other cars, valued at $2,413,176. There were also built 603 street-railroad cars, valued at $2,023,922: Of these 558 were passenger cars, valued at $1,903,317; 45 other cars, valued at $120,605.

Cars and General Shop Construction and Repairs by Steam Railroad Companies.

The cars and general shop construction and repairs made by the steam railroad companies in 1909, reached a total of $405,600,727. The value of the car department was $199,768,939. The value of the cars built was $13,326,171: Of these there were 218 passenger cars, valued at $1,291,354; 13,972 freight cars, valued at $11,767,664; the number of all other cars manufactured was 359, valued at $267,153. Repairs to cars of all kinds amounted to $147,194,065.

Cars, Street-Railroad.

The total value of the products of this industry in the United States, in 1909, was $7,809,866. There were constructed 1,922 electric-railroad cars, valued at $4,602,435: Of these there were 1,323 closed cars, valued at $3,500,781; 369 combination cars, valued at $704,309; 95 open cars, valued at $141,008; 92 freight, express, and mail cars, valued at $179,293; of all other varieties, 43, valued at $77,044. There were steam-railroad cars built for freight service, 167, all classes—valued at $111,813.

Shipbuilding, Including Boat Building.

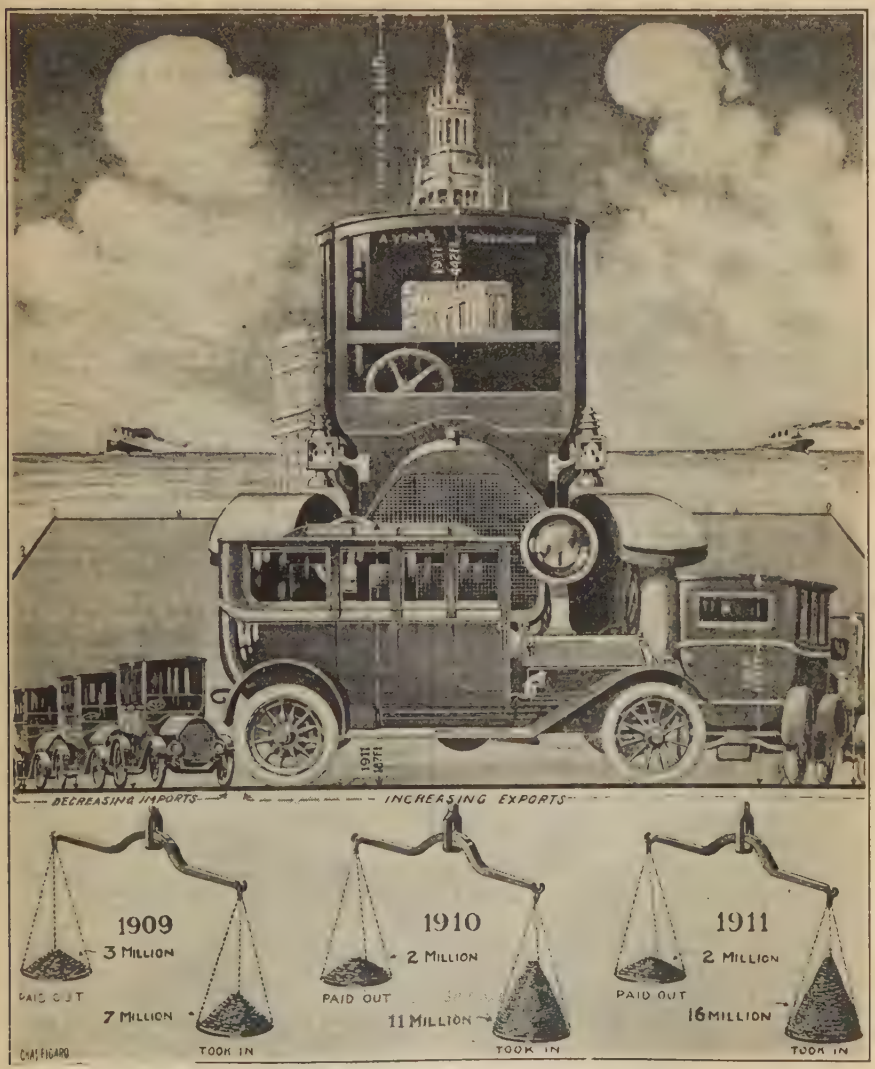
The total value of work done on the different classes of water craft, not in Government establishments, the value of the repair work, and all other products of the shipbuilding industry, in 1909, was $73,360,315. Work done during the year on vessels and boats, amounted to $42,310,925; vessels of 5 gross tons and over, $37,718,018; boats of less than 5 gross tons, $4,592,907; repair work, $26,678,643.

Bicycles, Motorcycles, and Parts.

The total value of bicycles and motorcycles, and parts, manufactured in the United States in 1909, was $10,698,567. 168,824 bicycles were manufactured, valued at $2,436,996; 18,628 motorcycles were made, their value being $3,015,988.

AUTOMOBILE INDUSTRY.

PRODUCT.	1909	
	Number.	Value.
Total value		**$249,202,075**
Automobiles	126,593	164,269,324
Gasoline	120,393	153,529,653
Electric	3,826	7,259,430
Steam	2,374	3,480,241
Passenger vehicles (pleasure, family, and public conveyances)	123,338	159,039,301
Gasoline	117,633	149,530,232
Electric	3,331	6,028,828
Steam	2,374	3,480,241
Buggies	4,582	2,391,250
Gasoline	4,314	2,039,129
Electric	268	352,121
Runabouts	36,204	28,030,479
Gasoline	35,347	27,116,901
Electric	496	648,630
Steam	361	264,948
Touring cars	76,114	113,403,188
Gasoline	73,883	109,844,295
Electric	243	387,526
Steam	1,988	3,171,367
Closed (limousine, cabs, etc.)	5,205	12,729,304
Gasoline	3,290	8,762,768
Electric	1,915	3,966,536
All other (omnibuses, sight-seeing wagons, ambulances, patrol wagons, etc.)	1,233	2,485,080
Gasoline	799	1,767,139
Electric	409	674,015
Steam	25	43,926
Business vehicles (merchandise)	3,255	5,230,023
Gasoline	2,760	3,999,421
Electric	495	1,230,602
Steam		
Delivery wagons	1,862	1,918,856
Gasoline	1,645	1,474,063
Electric	217	444,793
Steam		
Trucks	1,366	3,165,512
Gasoline	1,090	2,384,763
Electric	276	780,809
All other	27	145,655
Gasoline	25	140,655
Electric	2	5,000
All other products, including bodies and parts		$78,584,753
Amount received for custom work and repairing		6,317,998



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THE GROWTH OF OUR AUTOMOBILE INDUSTRY.

If all the material used in the automobiles manufactured in 1911 were put into a single car, the giant product would be 59 times as long, 59 times as high and 59 times as wide as an average machine. Our giant car would tower to a height of 442 feet, or within 100 feet of the top of the Municipal Building. During the year the automobile manufacturers of the United States produced 209,000 cars.

Comparison of our increasing exports with our decreasing imports.

Carriages and Wagons and Materials.

The total value of carriages and wagons and materials manufactured in the United States, in 1909, was $159,892,547. Of carriages (family and pleasure) there were made 828,411, valued at $47,756,118; 587,685 wagons, valued at $39,932,910, were manufactured; of these 154,631 were business wagons, their value being $16,440,816; 429,952 farm wagons, valued at $22,615,875; the remainder, government, municipal, etc., 3,102, valued at $876,219. Of public conveyances (cabs, hacks, hansoms, hotel coaches, omnibuses, etc.), 2,243 were manufactured, valued at $939,267; 100,899 sleighs and sleds, valued at $2,065,850.

Cars and General Shop Construction and Repairs by Street-Railroad Companies.

The cars and general shop construction and repairs by street-railroad companies in 1909, reached a total value of $31,962,561. The value of the motive power and machinery department, was $4,510,332. The value of the repairs to motors, etc., was $4,004,336. The value of the car department was $25,835,463. The value of all the cars built was $626,752: Of these there were 129 passenger cars, valued at $498,709; 63 freight cars, valued at $59,102; of all other cars there were 51 built, valued at $68,941.

VI. CLAY AND STONE PRODUCTS.

The total value of these products for the year 1909, was $168,895,365. The value of the brick and tile, terra-cotta, and fire-clay products, was $136,387,846; of common brick there were 9,787,671 thousand, valued at $57,216,789; of fire brick, 838,167 thousand, valued at $16,620,695; of the vitrified, paving, etc., 1,023,654 thousand, valued at $11,269,586; front, including fancy colored and fancy or ornamental brick, 821,641 thousand, valued at $9,886,292; the sand lime brick used had a value of $1,150,580; the enameled brick were valued at $993,902; the value of the drain tile was $9,798,978; the sewer pipe used was valued at $10,322,324; the value of the architectural terra-cotta was $6,251,625; the fireproofing, terra-cotta lumber and hollow building tile, or blocks, was valued at $4,466,708; the value of the tile, not drain, was $5,291,963; the value of the stove lining was $423,583; other material, valued at $2,694,821. The value of the pottery manufactured was $31,048,341.

Building Operations.

In 1911 the total cost of buildings, according to reports of municipal authorities to the Bureau of Statistics, was $702,143,956, against $726,436,975 in 1910. The total number of permits for the latter year was 192,978.

Cement.

The total value of the cement product in 1909, for the United States, was $63,205,455. There were manufactured 66,689,715 barrels of cement, valued at $53,610,563; of this 64,991,431 barrels was Portland, valued at $52,858,354; 1,537,638 was natural, valued at $652,756; 160,646 barrels puzzolan, valued at $99,453. The value of all other products of this industry, was $9,594,892.

Glass.

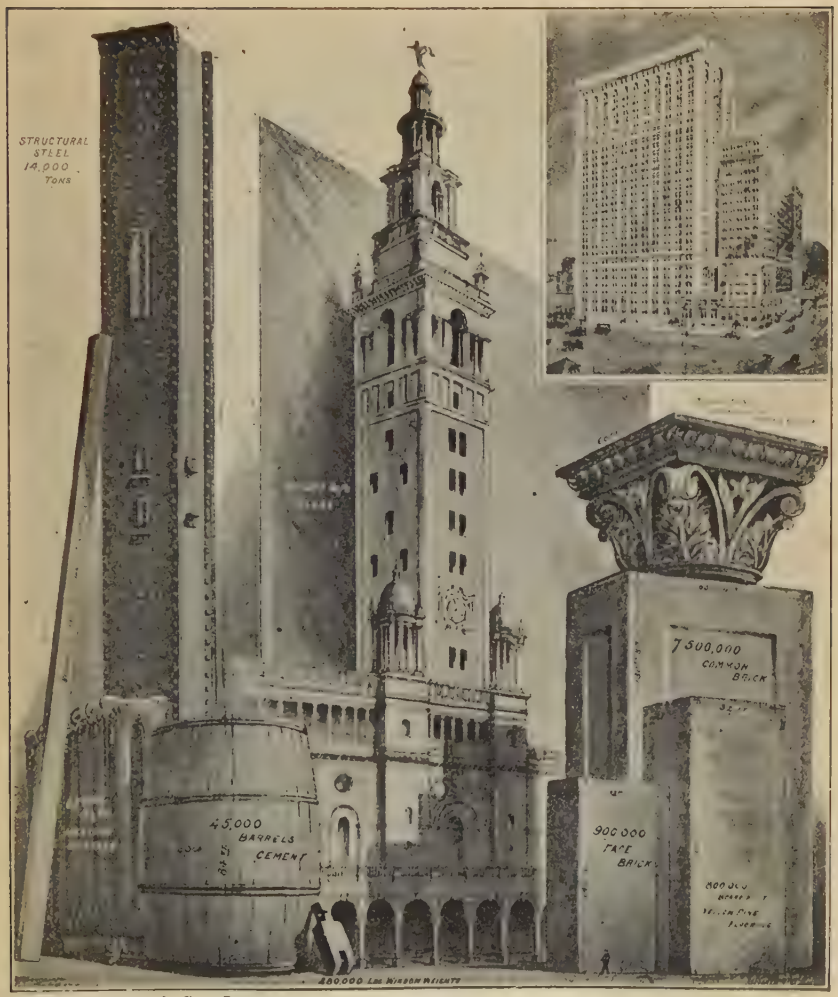
The total cost of the materials used in the manufacture of glass, in 1909, amounted to $32,119,499, while the total value of these products was $92,095,203 Of this amount the value of building glass aggregated $26,308,438; included under this head are 6,921,611 50-foot boxes of window glass, valued at $11,742,959; also included in this division is plate glass, of which there was cast a total of 60,105,694 square feet; of this amount 47,370,254 square feet was polished glass, valued at $12,204,875; the remainder, rough glass, made for sale,—205,690 square feet, valued at $37,431. Of cathedral glass there were 7,405,980 square feet, valued at $569,848; 15,409,966 square feet of skylight glass, valued at $788,726. The value of the pressed and blown glass was $27,398,445; Of this goods there was manufactured tableware, 100 pieces, 1,286,056 sets; jellies, tumblers, and goblets, 11,687,036 dozen; lamps, 322,482 dozen; chimneys, 6,652,967 dozen; lantern globes, 952,620 dozen; globes and other electrical goods, 11,738,798 dozen; shades, globes, and other gas goods, 1,541,449 dozen; blown tumblers, stem ware, and bar goods, 9,182,060 dozen; opal ware, 3,095,666 dozen; cut ware, 206,336 dozen. The value of the bottles and jars manufactured, was $36,018,333. Of prescriptions, vials, and druggists' wares, 3,624,022 gross were made; 2,345,204 gross of beer, soda and mineral glassware; 1,887,344 gross of liquors and flasks; 440,302 gross milk jars; 1,124,485 gross fruit jars; of battery jars and other electrical goods, 9,981 gross; of patent and proprietary glassware, 1,637,798 gross; of packers and preservers, 1,237,175 gross; of demijohns and carboys, 122,570 dozen.

Artificial Ice.

The total cost of the materials used in establishments for the manufacture of ice, in 1909, was $1,021,913. By the compressor system there were used 3,097,191 pounds of anhydrous, costing $826,222. By the absorption system there were used 369,093 pounds of anhydrous, valued at $100,283. There were also used 1,670,698 pounds of aqua, valued at $95,408.

The total value of the ice products for the year 1909 was $42,953,055. Of the ice itself there was 12,647,949 tons (2,000 pounds each), valued at $39,889,263: Of the can ice, 11,671,547 tons (2,000 pounds), valued at $37,085,533; of the plate ice, 976,402 tons (2,000 pounds), valued at $2,803,730.

The first permanent electric railway was operated near Berlin in 1881, and the first permanent elevated electric railway was operated in Chicago 1895.



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A MAMMOTH OFFICE BUILDING DISSECTED.

THE WHITEHALL BUILDING.

VII. LEATHER INDUSTRY.

	1909
MATERIALS.	
Total cost	**$248,278,933**
Tanning.	
Hides[1] (all kinds):	
Number	[2] 18,360,415
Cost	$119,410,767
Skins: [1]	
Number	97,680,571
Cost	$75,647,790
Calf and kip—	
Number	19,732,638
Cost	$31,790,572
Goat—	
Number	48,077,664
Cost	$27,833,214
Sheep—	
Number	26,082,060
Cost	$12,231,618
All other—	
Number	[3] 3,788,209
Cost	$3,792,386
Currying.	
Purchased rough leather used, cost	$9,556,257
Sides—	
Number	1,468,213
Cost	$4,967,781
Grains—	
Sides	525,786
Cost	$1,201,842
Splits—	
Number	2,043,283
Cost	$1,442,505
All other—	
Cost	$1,944,129
All other materials, cost	$43,664,119
PRODUCTS.	
Total value	**[4] $327,874,187**
Leather, value	$306,476,720
Sold in rough, value	$6,335,599
Sides—	
Number	828,887
Value	$3,539,617
Grains—	
Sides	317,814
Value	$718,562
Splits—	
Number	2,912,964
Value	$2,077,420
Sole, value	$88,331,713
Hemlock—	
Sides	7,963,728
Value	$32,237,151
Oak—	
Sides	3,805,861
Value	$26,083,793
Union—	
Sides	5,756,227
Value	$28,375,815

	1909
PRODUCTS—continued.	
Leather—Continued.	
Sole—Continued.	
Chrome—	
Sides	279,436
Value	$1,634,954
Upper, other than calf or kip skins, value	$39,951,460
Grain, satin, pebble, etc. (side leather)—	
Sides	7,946,769
Value	$24,198,993
Finished splits—	
Number	8,134,229
Value	$7,410,740
Patent and enameled shoe—	
Sides	2,705,291
Value	$8,341,727
Horsehides and coltskins—	
Number	1,342,938
Value	$4,953,145
Calf and kip skins, tanned and finished—	
Number	19,012,064
Value	$42,412,256
Grain finished—	
Number	17,516,910
Value	$39,982,447
Flesh finished—	
Number	1,495,154
Value	$2,429,809
Goatskins, tanned and finished—	
Number	47,907,211
Value	$40,882,640
Black—	
Number	40,351,192
Value	$33,949,575
Colored—	
Number	7,556,019
Value	$6,933,065
Sheepskins, tanned and finished—	
Number	19,665,155
Value	$12,236,687
Belting—	
Sides	1,042,070
Value	$6,995,133
Harness—	
Sides	3,946,235
Value	$24,802,734
Carriage, automobile, and furniture—	
Sides	1,398,842
Value	$14,266,742
Trunk, bag, and pocketbook, value	$6,198,544
Bookbinder's, value	$2,450,155
Glove, value	$4,913,543
All other, value	$11,746,369
All other products, value	$8,632,689
Work on materials for others	$12,764,778

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THE GREAT GLASS INDUSTRY OF THE U. S. AMOUNTING TO $92,000,000.

Boots and Shoes.

In 1909 there were produced in the United States 247,643,197 pairs of boots and shoes. The classification of this product was as follows,—Men's, 93,888,892; boys' and youths', 23,838,626; women's, 86,595,314; misses' and children's, 43,320,365. Of slippers there were manufactured 17,507,834 pairs, distributed as follows,—Men's, boys' and youths', 4,802,841 pairs; women's, misses', and children's, 12,704,993. There were 15,000,721 pairs of infants' shoes and slippers manufactured, and of all other goods of this nature there were 4,865,429 pairs.

The products of the essential-oil industry in 1909 had a total value of $1,737,234.

Gloves and Mittens—Leather.

The total value of the manufactures in the United States, in 1909, was $23,630,598. Of gloves, mittens, and gauntlets, there were manufactured 3,368,655 dozen pairs, valued at $22,525,861. Of these there were made for men 2,585,977 dozen pairs, valued at $17,060,797; this included 921,259 dozen pairs lined gloves and mittens, valued at $5,222,174; 1,664,718 dozen pairs unlined, valued at $11,838,623 For women and children there were manufactured 782,678 dozen pairs, valued at $5,465,064; this included 365,477 dozen pairs lined gloves and mittens, valued at $1,718,198 417,201 pairs unlined, valued at $3,746,866. The value of all other products of this industry was $1,104,737.

VIII. CHEMICALS AND ALLIED PRODUCTS.

The total value of chemicals and allied products in the United States in 1909 was $117,688,887. The value of the acids was $11,926,389; sodas were valued at $21,417,982; of potashes there were manufactured 1,866,570 pounds, valued at $88,940; the value of the alums manufactured was $2,578,842; coal-tar products were valued at $2,675,327; the value of the cyanides was $1,941,893; bleaching materials were valued at $1,635,046; chemical substances produced by the aid of electricity, were valued at $17,968,277; 121,946,967 pounds of calcium carbide, were produced, valued at $2,984,001; 11,802,076 pounds of anhydrous ammonia, valued at $2,503,315; of carbon dioxide, 47,238,267 pounds were produced, valued at $2,317,808.

Dyestuffs and Extracts.

The total value of these products for the year 1909 was $15,954,574. The 12,267,399 pounds of artificial dyestuffs were valued at $3,462,436.

Explosives.

The total cost of the materials used in the manufacture of explosives was $22,811,548; 188,889 tons of nitrate of soda were used, valued at $7,892,336; 51,764,694 pounds of mixed acids costing $1,512,626, were needed; 7,591,756 pounds of nitric acid, costing $541,314; 22,501 tons of sulphuric acid, costing $406,204; 17,389 tons of sulphur or brimstone, costing $367,866. The cost of all other materials used was $12,091,202. The total value of the manufactured products was $40,139,661; the value of the 177,155,851 pounds of dynamite used was $18,699,746; 28,913,253 pounds of nitroglycerin, sold as such, $3,162,434; 9,339,087 twenty-five pound kegs of blasting powder, valued at $9,608,265; of permissible explosives 9,607,448 pounds valued at $863,209; 12,862,700 pounds of gunpowder, valued at $1,736,427; 7,464,825 pounds of other explosives, valued at $3,913,787. The value of all other products was $2,155,793.

Fertilizers.

The total cost of the materials used in the making of fertilizers in 1909 was $69,521,920. The total value of the products was $103,960,213. 5,240,164 pounds of fertilizers, valued at $92,369,631.

Salt.

The total value of the salt products of the United States in 1909 was $11,327,834. There were 29,933,060 barrels of salt, valued at $8,311,729; 728,875 pounds of bromine, valued at $92,735; the value of all other products was $2,923,370.

SALT, CLASSIFIED BY GRADE (BARRELS).

Table and dairy	3,042,824
Common, fine	7,745,204
Common, coarse	2,843,393
Packers	385,802
Coarse, solar	1,109,396
Rock salt, mined	5,938,721
Milling, other grades and brine	8,867,720

PROCESS EMPLOYED

Total number of establishments	124
Number reporting:	
Solar	46
Kettle	1
Grainer	50
Open pan	11
Vacuum pan	21

See also Chapter on "Mines and Quarries."

Paint and Varnish.

In the manufacture of these products the following materials were used,—145,917 tons (2,000 pounds) of pig lead, costing $12,014,859; 1,683,382 gallons alcohol, costing $920,086, 1,327,157 gallons of which was wood alcohol, costing $693,362; 356,225 gallons grain alcohol, costing $226,724.

The total value of these products in 1909 was $124,889,422. The value of the pigments was $16,985,588; 85,234,414 pounds of white lead, dry, was valued at $3,921,803. The value of paints in oil was $56,763,296; 246,567,570 pounds white lead in oil, were valued at $15,234,411. The value of varnishes and japans was $31,262,535. The value of fillers, all kinds included, was $3,126,271; of these 1,159,569 gallons of liquid fillers were valued at $823,063.

Turpentine and Rosin.

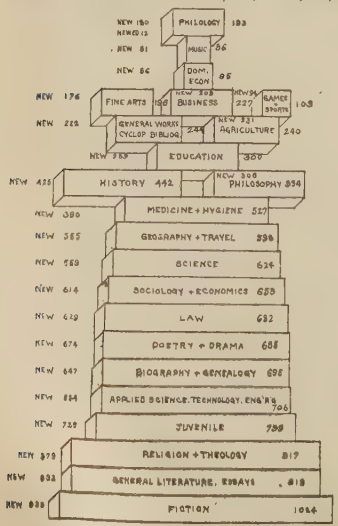
The total value of the turpentine and rosin industry for 1909 was $25,295,017; the 28,988,954 gallons of turpentine were valued at $12,654,228; the 3,263,857 barrels (280 pounds each), of rosin, were valued at $12,576,721.

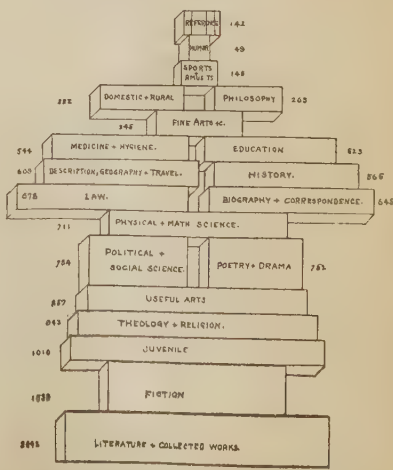
Tromsö
Verdö
Trondheim
Kristiansund
Aalesund
Sundswall
Bergen
Christiania
Stockholm
Helsingfors
Kronstadt
St. Petersburg
Wick
Stavanger
Kristiansand
Norrkoping
Revel
Riga
Libau
Memel
Dantzig
Stettin
Copenhagen
Aarhuus
Kiel
Hamburg
Malmo
Gothenburg
Christiansand
Aberdeen
Edinburgh
Glasgow
Londonderry
Belfast
Dublin
Galway
Limerick
Cork
Scilly Is.
Brest
Lorient
St. Nazaire
Nantes
Rochelle
Bordeaux
Bayonne
Ferrol
Coruna
Vigo
Oporto
Lisbon
Lagos
Tarifa
Tangier
Malaga
Barcelona
Valencia
Cartagena
Algiers
Oran
Bona
Tunis
Malta
Tripoli
Naples
Messina
Catania
Syracuse
Trapani
Palermo
Cagliari
Leghorn
Civita Vecchia
Ancona
Trieste
Fiume
Pola
Sebenico
Brindisi
Otranto
Corfu
Salonica
Smyrna
Constantinople
Batum
Odessa
Rostoff
Galatz
Brailo
Beirut
Port Said
Alexandria
Suez
Tenerife
Las Palmas
Madeira
Rio de Oro
Mogador
Tangier
Gibraltar
Portsmouth
Plymouth
Falmouth
Queenstown
Liverpool
Holyhead
Fleetwood
Barrow
Whitehaven
Greenock
Peterhead
Lerwick
Hull
Grimsby
Yarmouth
Harwich
Sheerness
Dover
Ramsgate
Portland
Weymouth
Southampton
Cherbourg
Havre
Dieppe
Boulogne
Calais
Ostend
Flushing
Rotterdam
Amsterdam
Helder
Emden
Borkum
Wilhelmshaven
Bremen
Cuxhaven
Kiel
Travemunde
Rostock
Stettin
Memel
Libau
Riga
Reval
Norrkoping
Stockholm
Gothenburg
Christiansand
Aarhuus
Copenhagen
Malmo
Hamburg
Kiel
Cuxhaven
Bremen
Wilhelmshaven
Borkum
Emden
Helder
Amsterdam
Rotterdam
Flushing
Ostend
Calais
Boulogne
Dieppe
Havre
Cherbourg
Southampton
Portland
Weymouth
Plymouth
Falmouth
Queenstown
Liverpool
Holyhead
Fleetwood
Barrow
Whitehaven
Greenock
Peterhead
Lerwick
Hull
Grimsby
Yarmouth
Harwich
Sheerness
Dover
Ramsgate
Gibraltar
Portsmouth
Tripoli
Bizerta
Sfax
Gabes
Tripoli
Alexandria
Suez
Port Said
Beirut
Smyrna
Constantinople
Batum
Odessa
Rostoff
Galatz
Brailo
Trieste
Fiume
Pola
Sebenico
Ancona
Leghorn
Civita Vecchia
Naples
Messina
Catania
Syracuse
Trapani
Palermo
Cagliari
Brindisi
Otranto
Corfu
Salonica
Malta
Tunis
Bona
Oran
Algiers
Cartagena
Valencia
Barcelona
Tarifa
Malaga
Tangier
Lisbon
Lagos
Oporto
Vigo
Ferrol
Coruna
Santander
Bilbao
Bayonne
Bordeaux
Rochelle
Nantes
St. Nazaire
Lorient
Brest
Scilly Is.
Cork
Limerick
Galway
Belfast
Londonderry
Glasgow
Greenock
Edinburgh
Peterhead
Aberdeen
Lerwick
Wick
Stavanger
Kristiansand
Christiansand
Bergen
Aalesund
Kristiansund
Trondheim
Sundswall
Soderhamn
Helsingfors
Kronstadt
St. Petersburg
Reval
Norrkoping
Stockholm
Gothenburg
Christiania
Malmo
Copenhagen
Aarhuus
Kiel
Hamburg
Stettin
Dantzig
Memel
Libau
Riga

IX. ELECTRICAL INDUSTRY.

PRODUCT.	1909
Total value	**$243,965,093**
Dynamos:	
Number	16,791
Kilowatt capacity	1,405,950
Value	$13,081,048
Dynamotors, motor generators, boosters, rotary converters, and double current generators	$3,154,733
Transformers	$8,801,019
Switchboards, panel boards, and cut-out cabinets	$5,971,804
Motors:	
Total number	504,030
Horsepower	2,733,418
Value	$32,087,482
For power—	
Number	243,423
Horsepower	1,683,677
Value	$18,306,451
For automobiles—	
Number	2,796
Horsepower	12,471
Value	$294,152
For fans—	
Number	199,113
Horsepower	178,033
Value	$2,450,739
For elevators—	
Number	4,988
Horsepower	63,585
Value	$1,183,653
For railways, and miscellaneous services, including value of parts and supplies—	
Number	53,710
Horsepower	795,652
Value	$9,847,487
Storage batteries, including value of parts and supplies:	
Weight of plates in pounds	23,119,331
Value	$4,678,209

PRODUCT.	1909
Primary batteries, including value of parts and supplies:	
Number	34,333,531
Value	$5,934,261
Arc lamps:	
Number	123,985
Value	$1,706,959
Searchlights, projectors, and focusing lamps	$935,874
Incandescent lamps	$15,714,809
Carbon filament	$6,157,066
Tungsten	$6,241,133
Gem, tantalum, glower, and vacuum and vapor lamps	$2,715,991
Decorative and miniature lamps, X-ray bulbs, vacuum tubes, etc	$600,619
Sockets, receptacles, bases, etc	$4,521,729
Electric-lighting fixtures of all kinds	$6,128,282
Telegraph apparatus	$1,957,432
Telephone apparatus	$14,259,357
Insulated wires and cables	$51,624,737
Electric conduits	$5,098,264
Annunciators—domestic, hotel, and office	$235,567
Electric clocks and time mechanisms	$352,513
Fuses	$1,001,719
Lightning arresters	$940,171
Rheostats and resistances	$2,674,963
Heating, cooking, and welding apparatus	$1,003,038
Electric flatirons	$951,074
Electric measuring instruments	$7,800,010
Electrical therapeutic apparatus	$1,107,858
Magneto-ignition apparatus, sparks, coils, etc	$6,092,343
Electric switches, signals, and attachments	$5,377,843
Circuit fittings of all kinds	$1,080,287
All other products, value	$39,691,708





Charts Prepared by F. E. Woodward, Washington, D. C.

ANALYSIS OF BOOKS PUBLISHED IN THE UNITED STATES, 1910-1911.

X. PAPER AND PULP.

	1909
MATERIALS.	
Total cost	$165,442,341
Pulp wood, cost	$33,772,475
Wood pulp, purchased:	
Tons	1,241,914
Cost	$43,861,357
Ground—	
Tons	452,849
Cost	$9,487,508
Soda fiber—	
Tons	154,626
Cost	$6,862,864
Sulphite fiber—	
Tons	626,029
Cost	$27,184,726
Other chemical fiber—	
Tons	8,410
Cost	$326,259
Rags, including cotton, flax waste and sweepings:	
Tons	357,470
Cost	$10,721,559
Old and waste paper:	
Tons	933,882
Cost	$13,691,120
Manila stock, including jute bagging, rope, waste, threads, etc.:	
Tons	117,080
Cost	$3,560,033
Straw:	
Tons	303,137
Cost	$1,460,282
All other materials, cost	$58,375,515
PRODUCTS.	
Total value	[1] $267,656,964
News paper:	
In rolls for printing—	
Tons	1,091,017
Value	$42,807,064
In sheets for printing—	
Tons	84,537
Value	$4,048,496
Book paper:	
Book—	
Tons	575,616
Value	$42,846,674
Coated—	
Tons	95,213
Value	$9,413,961
Plate, lithograph, map, wood-cut, etc.—	
Tons	6,498
Value	$555,352
Cover—	
Tons	17,578
Value	$1,982,853
Cardboard, bristol board, card middles, tickets, etc.—	
Tons	51,449
Value	$3,352,151
Fine paper:	
Writing—	
Tons	169,125
Value	$24,966,102
All other—	
Tons	29,088
Value	$4,110,536
Wrapping paper:	
Manila (rope, jute, tag, etc.)—	
Tons	73,731
Value	$6,989,436
Heavy (mill wrappers, etc.)—	
Tons	108,561
Value	$4,380,794
Straw—	
Tons	32,988
Value	$870,419

	1909
PRODUCTS—continued.	
Wrapping paper—Continued.	
Bogus or wood manila, all grades—	
Tons	367,932
Value	$19,777,707
All other—	
Tons	179,855
Value	$10,202,035
Boards:	
Wood pulp—	
Tons	71,036
Value	$2,639,496
Straw—	
Tons	171,789
Value	$3,750,851
News—	
Tons	74,606
Value	$2,215,469
All other—	
Tons	514,208
Value	$17,539,768
Other paper products:	
Tissues—	
Tons	77,745
Value	$8,553,654
Blotting—	
Tons	9,577
Value	$1,186,180
Building roofing, asbestos, and sheathing—	
Tons	225,824
Value	$9,251,368
Hanging—	
Tons	92,158
Value	$4,431,514
Miscellaneous—	
Tons	96,577
Value	$6,869,169
Wood pulp made for sale or for consumption in mills other than where produced:	
Ground—	
Tons	310,747
Value	$5,649,466
Soda fiber—	
Tons	155,844
Value	$6,572,152
Sulphite fiber—	
Tons	444,255
Value	$17,955,748
All other products, value	$4,738,549
Wood pulp.	
Quantity produced (including that used in mills where manufactured), total tons	2,495,523
Ground, tons	1,179,266
Soda fiber, tons	298,626
Sulphite fiber, tons	1,017,631
EQUIPMENT.	
Paper machines:	
Total number	1,480
Capacity, yearly, tons	5,293,397
Fourdrinier—	
Number	804
Capacity per 24 hours, tons	10,508
Cylinder—	
Number	676
Capacity per 24 hours, tons	6,316
Pulp:	
Grinders, number	1,435
Digesters, total number	542
Sulphite fiber, number	348
Soda fiber, number	194
Capacity, yearly, tons of pulp	3,405,621
Ground, tons	1,809,685
Sulphite, tons	1,250,983
Soda, tons	344,953

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THE CIVILIZED WORLD'S CONSUMPTION OF PAPER PRESENTED IN GRAPHICAL FORM.

PUBLICATIONS.

PRODUCT.	1909
Total value	**$737,876,087**
Publications:	
Newspapers and periodicals	$337,596,288
Subscriptions and sales	$135,063,043
Advertising	$202,533,245
Newspapers	$232,993,094
Subscriptions and sales	$84,438,702
Advertising	$148,554,392
Periodicals	$104,603,194
Subscriptions and sales	$50,624,341
Advertising	$53,978,853
Ready prints, patent insides and outsides	$2,293,077
Books and pamphlets—	
Published, or printed and published	$62,930,394
Printed for publication by others	$10,209,509
Sheet music and books of music—	
Published or printed and published	$5,510,698
Printed for publication by others	$1,000,966
Products for sale and in execution of orders:	
Job printing	$207,940,227
Book binding and blank books	$50,552,808
Electrotyping, engraving, and lithographing	$47,956,979
All other products	$11,885,141
NEWSPAPERS AND PERIODICALS.	
Number	**22,141**
Aggregate circulation	**164,463,040**
By period of issue:	
Daily (exclusive of Sunday)—	
Number	2,600
Aggregate circulation	24,211,977
Sunday—	
Number	520
Aggregate circulation	13,347,282
Semiweekly and triweekly—	
Number	708
Aggregate circulation	2,648,308
Weekly—	
Number	15,097
Aggregate circulation	40,822,965
Monthly—	
Number	2,491
Aggregate circulation	63,280,535
All other—	
Number	725
Aggregate circulation	20,151,973
By character:	
News, politics, and family reading—	
Number	17,698
Aggregate circulation	61,074,990
Religious—	
Number	1,251
Aggregate circulation	29,523,777
Agricultural, horticultural, dairy, stock raising, etc.—	
Number	316
Aggregate circulation	11,327,253

PRODUCT.	1909
NEWSPAPERS AND PERIODICALS—Continued.	
By character—Continued.	
Commerce, finance, insurance, railroads, etc.—	
Number	264
Aggregate circulation	1,411,738
Trade journals generally—	
Number	685
Aggregate circulation	3,572,441
General literature, including monthly and quarterly magazines—	
Number	340
Aggregate circulation	31,322,035
Medicine and surgery—	
Number	197
Aggregate circulation	931,584
Law—	
Number	56
Aggregate circulation	151,346
Science and mechanics—	
Number	139
Aggregate circulation	1,421,955
Fraternal orgainizations—	
Number	419
Aggregate circulation	6,982,235
Education and history—	
Number	202
Aggregate circulation	1,879,383
Society, art, music, fashions, etc.—	
Number	164
Aggregate circulation	13,445,661
College and school periodicals—	
Number	271
Aggregate circulation	330,705
Miscellaneous—	
Number	139
Aggregate circulation	1,087,937
By language:	
English—	
Number	20,744
Aggregate circulation	155,432,243
Foreign (including foreign and English)—	
Number	1,397
Aggregate circulation	9,030,797
French—	
Number	39
Aggregate circulation	446,739
German—	
Number	692
Aggregate circulation	4,434,146
Italian—	
Number	104
Aggregate circulation	500,475
Scandinavian—	
Number	161
Aggregate circulation	1,118,601
Slavonic—	
Number	169
Aggregate circulation	917,649
All other—	
Number	232
Aggregate circulation	1,613,187

The earliest advertisement in England was found in "Perfect Occurrences of Every Daie" 1647.

PUBLICATIONS BY STATES.

Showing the number of newspapers and periodicals of all issues published in the United States, Territories, and Dominion of Canada; the number of towns in which newspapers are published, and the number of towns which are county seats.

STATES, TERRITORIES AND CANADIAN PROVINCES.	No. of Towns in which Papers are published.	No. of Towns which are County Seats.	ISSUES. Daily.	Tri-Weekly.	Semi-Weekly.	Weekly.	Fortnightly.	Semi-Monthly.	Monthly.	Bi-Monthly.	Quarterly.	Miscellaneous.	Total—all issues.
NEW ENGLAND STATES.													
Connecticut	65	9	36		8	89	2	1	14		4		154
Maine	71	15	13	1	1	95		1	22		4		137
Massachusetts	204	20	85	2	9	374	3	9	134	8	30	2	656
New Hampshire	66	12	11	2	1	83			13	1			111
Rhode Island	18	4	12		3	26		1	10	1			53
Vermont	68	12	10			83		1	5		1	1	101
	492	72	167	5	22	750	5	13	198	10	39	3	1212
NEW YORK.													
New York	500	62	204	4	44	1066	8	39	604	13	34	4	2020
MIDDLE ATLANTIC STATES.													
Delaware	14	3	3			27		1	4				35
District of Columbia			7			22			37	4	7		77
Maryland	62	23	16	1	2	117	1	6	29	1	6	1	180
New Jersey	164	21	50	1	5	280		3	29	1	2		371
Pennsylvania	457	67	215	6	43	847	6	11	239	8	37	2	1414
	697	114	291	8	50	1293	7	21	338	14	52	3	2077
SOUTHERN STATES.													
Alabama	147	69	27		7	201		8	12		1		256
Arkansas	169	84	34		8	248		3	9	1			303
Florida	93	46	19		3	144			10				176
Georgia	207	137	28	2	12	260	2	8	49	3	1		374
Kentucky	154	117	31	2	25	231		10	27		4	1	331
Louisiana	107	56	19	1	7	171	1	5	19				223
Mississippi	148	85	14		6	214	2	5	15				256
North Carolina	158	85	31		21	204	1	11	27		4	1	299
South Carolina	85	43	14	1	21	120		5	16				177
Tennessee	144	87	17		8	227		3	39		16		310
Texas	502	222	96		29	808	1	8	66		2		1010
Virginia	131	66	35	2	7	167	1	3	32	3	6		256
West Virginia	94	55	30		4	172		1	14				221
	2219	1152	395	8	158	3175	8	70	335	7	34	2	4192
MIDDLE WESTERN STATES.													
Illinois	645	102	170	3	34	1073	5	26	443	7	13	2	1766
Indiana	374	91	158	5	23	525		6	61	1	8		787
Michigan	303	82	83	5	24	535	1	1	85		1		738
Ohio	413	88	174	5	53	726	3	13	155	8	22	1	1162
Wisconsin	374	71	63	1	21	531	1	3	56	1	1		678
	2109	434	648	19	157	3390	10	52	790	17	45	3	5131
WESTERN STATES.													
Colorado	181	59	47	2	6	306		3	31	1	1		397
Iowa	573	99	66	3	43	773		7	64	1	1	1	959
Kansas	450	105	67	1	8	628		3	23	1	1		732
Minnesota	434	85	38	1	3	636	2	11	51	2	1		745
Missouri	460	113	82		14	742	5	15	116	1	10		985
Montana	100	29	17		7	135		1	8				168
Nebraska	395	91	30	2	16	539	1	3	34				625
New Mexico Territory	77	24	6		1	115			2	2			126
North Dakota	268	50	12			330		1	5				348
Oklahoma	389	76	51		2	559		5	17				634
South Dakota	313	57	20		5	415		1	13				454
Wyoming	49	15	5		5	61			5				76
	3689	808	441	9	110	5239	8	50	369	8	14	1	6249
PACIFIC SLOPE STATES.													
Arizona Territory	31	14	16			48		2	3				69
California	309	57	161	4	31	502	2	9	101	5	1		816
Idaho	102	27	10		6	128			7		1		152
Nevada	29	14	1	3		14							18
Oregon	140	34	32	2	11	200	1	1	26				273
Utah	53	21	6	3	7	69		3	9				97
Washington	196	39	36		5	296	1	3	40			1	382
	880	206	272	12	60	1277	4	18	186	5	2	1	1837
OUTLYING TERRITORIES.													
Alaska	16		11			14							25
Hawaii	5		7	4	2	15			7				35
Philippines	6		12	1	2	4			17			1	37
Porto Rico	5	4	11			6		3	2				22
	32	1	41	5	4	39		3	26			1	119
CANADIAN PROVINCES.													
Alberta	71		9		1	89	2	2	1				104
British Columbia	50	6	17	1	7	67			12				104
Manitoba	66		9		1	98		4	25				137
Saskatchewan	120		7		2	137			4			1	151
Yukon	2		1			3							4
New Brunswick	18	6	8	1	10	24		2	9	1			55
Nova Scotia	39	16	15	1	3	51	2	2	6		2		82
Ontario	282	47	57	1	19	442	4	11	136	1	10		681
Prince Edward Island	4	2	4		1	9			2				16
Quebec	47	22	20	1	1	100	1		30	1	2		156
Newfoundland	6	3	4			9			4		1		18
	705	102	151	5	45	1029	9	21	229	3	15	1	1508

Ayer's Newspaper Annual.

INTERNATIONAL BOOK PRODUCTION.

TABLE OF BOOK PRODUCTION OF LEADING COUNTRIES—1901–1910.

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Germany	25,331	26,906	27,606	28,378	28,886	28,703	30,073	30,317	31,051	31,281
France	13,053	12,199	12,264	12,139	12,416	10,898	10,785	11,073	13,185	12,615
Great Britain	6,044	7,381	8,381	8,334	8,252	8,603	9,914	9,821	10,725	10,804
Italy	.....	.....	.....	.....	.....	6,822	7,040	6,918	6,833	6,788
Switzerland	1,766	1,655	2,452	2,739	3,316	3,249	3,085	4,256	4,390	4,290
Holland	2,837	2,917	3,005	3,403	3,290	3,346	3,408	3,258	3,652	3,777
Belgium	2,613	2,499	2,639	2,734	2,624	2,410	2,680	2,763	2,697	2,588
United States	8,141	7,833	7,865	8,291	8,122	7,139	9,620	9,254	10,901	13,470

Publishers' Weekly.

RECORD OF AMERICAN BOOK PRODUCTION.

International Classification	For 1911						For 1910					
	New Publications		By Origin				New Publications		By Origin			
	New Books	New Editions	American Authors	English and Other Foreign Authors: American Manuf.	English and Other Foreign Authors: Imported	Total	New Books	New Editions	American Authors	English and Other Foreign Authors: American Manuf.	English and Other Foreign Authors: Imported	Total
Philosophy	305	29	244	18	72	334	248	17	204	17	44	265
Religion and Theology	879	38	662	48	207	917	894	49	630	55	258	943
Sociology and Economics	614	39	559	21	73	653	748	36	705	3	76	784
Law	629	53	675	4	3	682	620	58	669	1	8	678
Education	289	11	269	8	23	300	504	19	378	43	102	523
Philology	180	12	89	60	43	192	.....	.....	.....	.....	.....	.....
Science	559	65	492	10	122	624	644	67	570	6	135	711
Applied Science, Technology, Engineering	584	122	575	7	124	706	721	136	765	3	89	857
Medicine, Hygiene	390	137	460	20	47	527	369	175	471	10	63	544
Agriculture	231	9	219	...	21	240	287	45	272	4	56	332
Domestic Economy	81	14	86	2	7	95						
Business	209	18	206	3	18	227	.....	.....	.....	.....	.....	.....
Fine Arts	176	20	105	7	84	196	324	21	180	12	153	345
Music	81	5	62	4	20	86						
Games, Sports, Amusements	94	9	80	2	21	103	126	19	122	....	23	145
General Literature, Essays	892	27	523	170	226	919	1399	692	981	297	813	2091
Poetry and Drama	674	11	385	148	152	685	721	31	481	161	110	752
Fiction	999	25	701	121	202	1024	1303	236	815	524	200	1539
Juvenile Publications	725	9	439	36	259	734	935	75	663	30	317	1010
History	425	17	326	15	101	442	526	39	411	18	136	565
Geography and Travel	555	43	381	25	192	598	544	55	365	5	229	599
Biography, Genealogy	647	48	433	36	226	695	631	14	423	23	199	645
General Cyclopædias, General Works, Bibliographies, Miscellaneous	222	22	212	6	26	244	127	15	104	3	35	142
Total	10,440	783	8183	771	2269	11,123	11,671	1799	9209	1215	3046	13,470

Publishers' Weekly.

RHODES SCHOLARSHIPS.

Under the will of Mr. Cecil Rhodes a number of Colonial, American and German scholarships were established, in order to instill into the minds of colonists the advantage to the Colonies as well as to the United Kingdom of the retention of the unity of the Empire; to encourage in the students from the United States of America an attachment to the country from which they have sprung; and to further a good understanding between England, Germany, and the United States.

There are in all seventy-eight colonial scholarships for male students of $1,500 each a year for three years at the University of Oxford, these colonial scholarships being spread over most of the colonies, twenty-four being allotted to Canada, eighteen to Australia, twelve to Cape Colony, nine to Rhodesia, and three each to Natal, New Zealand, Newfoundland, Bermuda and Jamaica.

Two Oxford scholarships are to be allotted to each State and Territory of the United States of America, tenable for three years, each of $1,500; also, five German scholarships, each of $1,250, tenable at Oxford for three years, the holders to be nominated by the German Emperor.

So that the students who shall be elected to the scholarships shall not be merely bookworms, regard is to be had, not only to their "literary and scholastic attainments," but also to their "fondness of and success in manly outdoor sports, qualities of manhood, truth, courage, devotion to duty, sympathy for and protection of the weak, kindliness, unselfishness, and fellowship," moral force of character and instinct of leadership. "No student shall be qualified or disqualified for election to a scholarship on account of his race or religious opinion."

BOOK PRODUCTION OF LEADING COUNTRIES, 1910, BY CLASSES.

	Germany	Great Britain	France	United States
Fiction	.....	2833	1152	1797
Law	.....	248	386	678
Religion	2510	1064	888	943
Education	4852	659	1160	523
Essays, Miscellany	4815	272	142	2042
Juvenile Publications	.....	....		1080
Sociology	3125	816	1413	784
Poetry and Drama	....	590	1028	752
Science	1750		417	711
History	1254	860	1718	565
Biography				645
Medicine	1981	398	1230	544
Description and Travel	1480	604	394	599
Fine Arts	2089	1254	328	365
Applied Science	2082		....	857
Philosophy	668	....	168	265
Household Science	1030	....	19	332
Agriculture			282	
Sports, Games	.....	....	77	145
Wit and Humor	....	....	....	49
Philology	1884	....	....	....
Military Science	667		464	
General Works	1094	1206		142

Printing was originally practiced by the Chinese in very early times; the origin of the present system seems to be very doubtful. The first metal plate from which impressions on paper were taken seems to have been executed in 1452. It was a pax or metal plate used in the Roman Catholic service. Early books containing engravings reproduced from metal plates are the "Kalendar" dated 1465, and the "Monte Santo de Dio," 1477. The first engraver proper who seems to have done nothing but engrave was Antonio Raimondi (1488-1530).

The first steam turbine was built in 1894 by the Hon. C. A. Parsons of Newcastle-on-Tyne; the first Atlantic passage turbine steamer was launched in 1904.

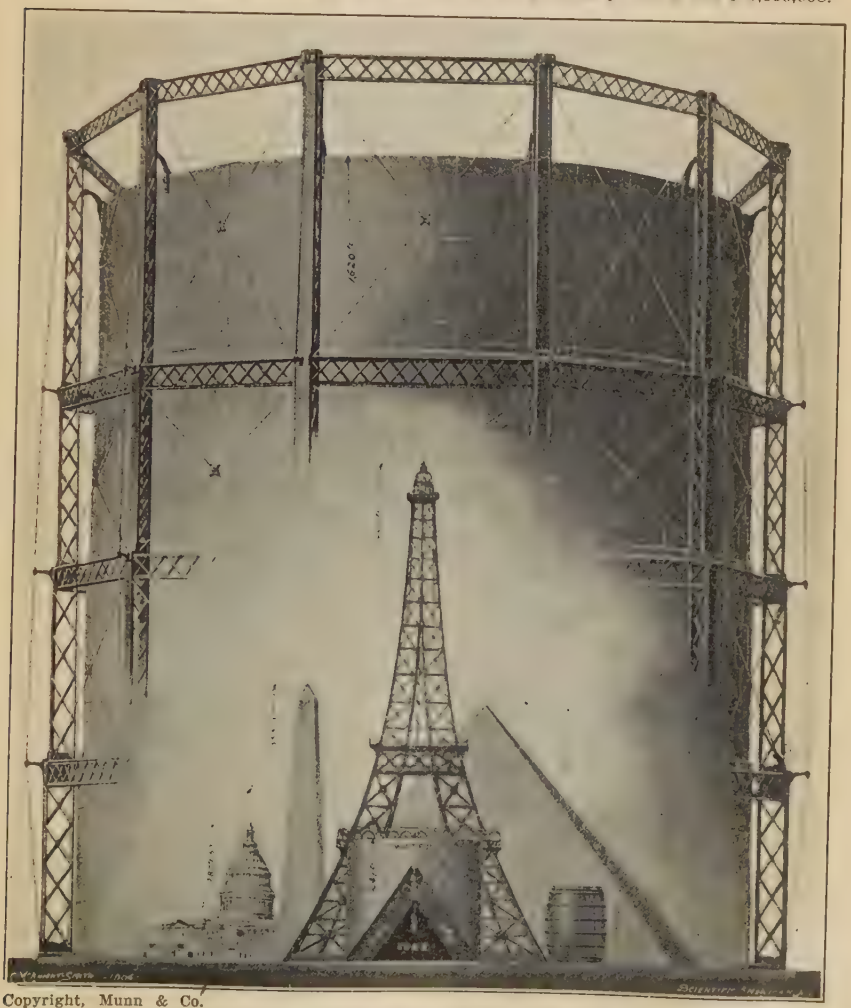
BOOK PRODUCTION OF LEADING COUNTRIES.

Country.	Year.	Books.	Year.	Periodic'ls.
Algeria	——	——	1908	282
Argentine Republic	——	——	1900	739
Australia	——	——	1903	1,000
Austria	1901	2,050	1910	3,952
Belgium	1910	2,588	1910	1,655
Brazil	——	——	1902	300
Bulgaria	——	——	1897	90
Canada	1893	450	1910	1,429
Cape of Good Hope	——	——	1900	90
Ceylon	1909	422	——	——
Chili	1891	400	1896	312
China	——	——	1907	123
Costa-Rica	——	——	1903	18
Denmark	1910	3,305	1910	1,413
Egypt	1898	160	1902	120
Finland	——	——	1909	366
France	1910	11,266	1908	8,658
Germany	1910	31,281	1910	10,017
Great Britain	1910	10,804	1907	4,329
Greece	——	——	1895	130
Haiti	——	——	1903	27
Hawaii	——	——	1908	45
Holland	1910	3,777	1908	1,492
Hungary	1898	1600	1904	1,644
Iceland	1903	212	1903	40
India	1895	8,000	1899	1,000
Ireland	1902	180	1902	30
Italy	1910	6,788	1907	3,068
Japan	1909	34,730	1909	2,727
Luxemburg	1910	97	1908	53
Mexico	——	——	1892	300
Norway	1904	682	1903	497
Paraguay	——	——	1908	21
Persia	——	——	1892	10
Portugal	——	——	1894	22
Roumania	1901	1,740	1903	330
Russia	1910	29,057	1910	2,391
Servia	——	——	1897	80
Spain	1902	1,400	1900	1,350
Sweden	1904	1,474	1906	804
Switzerland	1910	4,290	1909	1,332
Turkey	1890	900	1909	380
United States	1910	13,470	1910	22,806
Uruguay	1906	110	1906	240
Venezuela	——	——	1908	237

XI. MINOR INDUSTRIES.

Gas, Illuminating and Heating.

The total cost of the materials used in the manufacture of this product in the year 1909 was $52,427,844; 4,940,598 tons of coal cost $16,304,832; 579,657,152 gallons of oil cost $17,345,750; 591,919 tons coke, costing $2,-667,706; all other materials cost $16,109,556. The total value of these products in 1909 was $166,814,371: 150,835,793 cubic feet (thousands) of gas were produced, having a value of $138,615,309; 19,985,253 cubic feet (thousands) straight coal, valued at $18,065,841; 25,186 cubic feet (thousands) of acetylene, valued at $361,348; 82,049,683 bushels of coke were produced, valued at $5,723,215; 92,152,-938 gallons of tar, valued at $1,875,549; the value of all other products was $13,556,908.



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THE MAGNITUDE OF THE GAS INDUSTRY.

A Week's Supply of Gas. Fuel for 23 Million Horse-Power Hours. The Gas Holder contains 2,163,207,368 Cubic Feet.

Laundries in 1909.

Number of establishments	5,186
Capital invested	$68,935,000
Cost of materials used	17,696,000
Salaries and wages, total	53,007,747
Salaries	8,180,769
Wages	44,826,978
Miscellaneous expenses	14,483,497
Value of products, or amount received for work done	$104,680,086

Pianos and Organs and Materials.

In 1909, the total value of the pianos and organs, and materials, in establishments especially designed for their manufacture throughout the United States, amounted to $89,789,544. The whole number of pianos manufactured was 374,154, valued at $59,501,225: Of these there were 365,413 upright pianos, valued at $55,462,556; 330,918 pianos without player attachment, valued at $46,187,555; 34,495 pianos for or with player attachment, valued at $9,275,001; 8,741 grand pianos, valued at $4,038,669. There were 10,898 player attachments made separate from pianos, valued at $1,474,630. The whole number of organs made was 65,335, valued at $5,309,016: Of these there were 1,224 pipe organs, valued at $2,713,587; 64,111 reed organs, valued at $2,595,429. The value of other parts and materials manufactured, was $20,417,762; the value of all other products was $3,086,911.

Phonographs and Graphophones.

The total value of the phonographs, graphophones, and records manufactured in 1909, throughout the United States, was $11,725,996. There were 344,681 phonographs and graphophones made, valued at $5,406,684; 27,183,959 records and blanks, valued at $5,007,104; all other products were valued at $1,312,208. Since 1909 the products have vastly increased in quantity and value.

TABLE OF HEIGHT AND WEIGHT AT VARYING AGES.

Based upon an Analysis of 74,162 accepted Male Applicants for Life Insurance, as reported to The Association of Life Insurance Medical Directors, 1897.

Ages.	15—24	25—29	30—34	35—39	40—44	45—49	50—54	55—59	60—64	65—69
5 feet 0 inches	96	100	102	105	106	107	107	107	105	
	120	125	128	131	133	134	134	134	131	
	144	150	154	157	160	161	161	161	157	
1	98	101	103	105	107	109	109	109	107	
	122	126	129	131	134	136	136	136	134	
	146	151	155	157	161	163	163	163	161	
2	99	102	105	106	109	110	110	110	110	
	124	128	131	133	136	138	138	138	137	
	149	154	157	160	163	166	166	166	164	
3	102	105	107	109	111	113	113	113	112	112
	127	131	134	136	139	141	141	141	140	140
	152	157	161	163	167	169	169	169	168	168
4	105	108	110	112	114	115	116	116	115	114
	131	135	138	140	143	144	145	145	144	143
	157	162	166	168	172	173	174	174	173	172
5	107	110	113	114	117	118	119	119	118	118
	134	138	141	143	146	147	149	149	148	147
	161	166	169	172	175	176	179	179	178	176
6	110	114	116	118	120	121	122	122	122	121
	138	142	145	147	150	151	153	153	153	151
	166	170	174	176	180	181	184	184	184	181
7	114	118	120	122	124	125	126	126	126	125
	142	147	150	152	155	156	158	158	158	156
	170	176	180	182	186	187	190	190	190	187
8	117	121	123	126	128	129	130	130	130	130
	146	151	154	157	160	161	163	163	163	162
	175	181	185	188	192	193	196	196	196	194
9	120	124	127	130	132	133	134	134	134	134
	150	155	159	162	165	166	167	168	168	168
	180	186	191	194	198	199	200	202	202	202
10	123	127	131	134	136	137	138	138	138	139
	154	159	164	167	170	171	172	173	173	174
	185	191	197	200	204	205	206	208	208	209
11	127	131	135	138	140	142	142	142	141	144
	159	164	169	173	175	177	177	178	180	180
	191	197	203	208	210	212	212	214	216	216
6 0	132	136	140	143	144	146	146	146	148	148
	165	170	175	179	180	183	182	183	185	185
	198	204	210	215	216	220	218	220	222	222
1	136	142	145	148	149	151	150	151	151	151
	170	177	181	185	186	189	188	189	189	189
	204	212	217	222	223	227	226	227	227	227
2	141	147	150	154	155	157	155	155	154	154
	176	184	188	192	194	196	194	194	192	192
	211	221	226	230	233	235	233	233	230	230
3	145	152	156	160	162	163	161	158		
	181	190	195	200	203	204	201	198		
	217	228	234	240	244	245	241	238		

SUMMARY OF MANUFACTURES: BY SPECIFIED INDUSTRIES, 1905.

Source: Reports of the Bureau of the Census, Department of Commerce and Labor. The figures for some industries do not represent the total value of the products, because important establishments that manufacture the same class of products may be included in other industries. [Primary horse-power includes power generated in manufacturing establishments, plus electric and other power rented from outside sources; it does not include electric power generated by primary units of the establishments reporting.]

INDUSTRY.	Persons Engaged.	Primary Horse-Power.	Value of Products
Agricultural implements	60,229	100,601	$146,329,000
Artificial flowers and feathers and plumes	11,583	334	23,981,000
Artificial stone	15,202	12,185	18,596,000
Artists' materials	865	1,628	2,340,000
Automobiles, including bodies and parts	85,359	75,550	249,202,000
Awnings, tents and sails	5,747	2,022	14,499,000
Axle grease	334	492	1,481,00
Babbitt metal and solder	1,491	2,293	19,768,000
Bags, other than paper	8,838	6,855	54,882,000
Bags, paper	3,683	3,885	15,698 000
Baking powders and yeast	3,531	3,335	20,775 000
Baskets, and rattan and willow ware	5,419	7,196	5,695,000
Beet sugar	8,389	57,202	48,122 000
Belting and hose, leather	4,370	5,438	23,692,000
Belting and hose, woven and rubber	7,304	6,319	24,729,000
Bicycles, motor cycles and parts	5,017	5,932	10,699,000
Billiard tables and materials	1,776	2,642	5,878,000
Blacking and cleansing and polishing preparations	4,407	3,977	14,679,000
Bluing	545	242	1,074,000
Bone, carbon and lampblack	302	1,023	1,093,000
Boots and shoes, including cut stock and findings	215,923	96,302	180,060,000
Boots and shoes, rubber	18,899	25,903	49,721,000
Boxes, cigar	6,852	6,049	8,491,000
Boxes, fancy and paper	43,568	23,323	54,450,000
Brass and bronze products	45,441	106,120	149,989,000
Bread and other bakery products	144,322	65,298	396,865,000
Brick and tile	85,764	341,169	92,776,000
Brooms and brushes	15,143	8,800	29,126,000
Butter, cheese and condensed milk	31,506	101,349	274,558,000
Butter, reworking	418	1,471	8,200,000
Buttons	18,004	12,831	22,708,000
Calcium lights	26	53	52,000
Candles	649	799	3,130,000
Canning and preserving	71,972	81,179	157,101,000
Card cutting and designing	702	269	1,031,000
Carpets and rugs, other than rag	34,706	38,553	71, 188,000
Carpets, rag	2,688	2,651	2,568,000
Carriages and sleds, children's	5,769	5,281	8,805,000
Carriages and wagons and materials	82,944	126,032	159,893,000
Cars and general shop construction and repairs by steam-railroad companies	301,273	293,361	405,601,000
Cars and general shop construction and repairs by street-railroad companies	23,699	35,794	31,963,000
Cars, steam-railroad, not including operations of railroad companies	47,094	97,797	123,730,000
Cars, street-railroad, not including operations of railroad companies	4,005	15,161	7,810,000
Cash registers and calculating machines	9,249	6,944	23,708,000
Cement	29,551	371,799	63,205,000
Charcoal	731	165	872,000
Chemicals	27,791	208,604	117,689,000
China decorating	436	18	786,000
Chocolate and cocoa products	3,404	10,593	22,390, 000
Clocks and watches, including cases and materials	25,439	14,957	35,197,000
Cloth, sponging and refinishing	1,167	704	1,544,000
Clothing, horse	1,830	1,454	4,135,000
Clothing, men's, including shirts	271,437	42,725	568,077,000
Clothing, men's, buttonholes	1,031	176	781,000
Clothing, women's	179,021	22,294	384,752,000
Coffee and spice, roasting and grinding	13,516	22,234	110,533,000
Coffins, burial cases, and undertakers' goods	11,448	16,490	24,526,000
Coke	31,226	62,602	95,697,000
Confectionery	54,854	35,870	134,796,000

SUMMARY OF MANUFACTURES: BY SPECIFIED INDUSTRIES, 1909. — Continued

INDUSTRY.	Persons Engaged.	Primary Horse-Power.	Value of Products.
Cooperage and wooden goods, not elsewhere specified	29,717	65,108	60,248, 000
Copper, tin and sheet-iron products	86,934	62,366	199,824,000
Cordage and twine, jute and linen goods	27,214	78,549	61,020,000
Cordials and syrups	1,638	1,154	9,662,000
Cork, cutting	3,376	3,746	5,940,000
Corsets	19,611	4,581	33,257,000
Cotton goods, including cotton small wares	387,771	1,296,517	628,392,000
Crucibles	398	816	1,849,000
Cutlery and tools, not elsewhere specified	37,161	68,294	53,266,000
Dairymen's, poulterers', and apiarists' supplies	6,431	6,898	15,463,000
Dentists' materials	1,982	865	10,836,000
Drug grinding	1,152	3,322	6,007,000
Dyeing and finishing textiles	47,303	107,746	83,556,000
Dyestuffs and extracts	3,015	22,213	15,955,000
Electrical machinery, apparatus and supplies	105,600	158,768	221,309,000
Electroplating	3,558	4,461	4,510,000
Emery and other abrasive wheels	2,446	4,005	6,711,000
Enameling and japanning	2,418	1,695	3,316,000
Engravers' materials	189	549	921,000
Engraving and dyesinking	1,782	768	2,250,000
Engraving, wood	480	39	711,000
Explosives	7,058	28,601	40,140,000
Fancy articles, not elsewhere specified	14,194	8,310	22,632,000
Fertilizers	21,950	64,711	103,960,000
Files	4,521	7,383	5,691,000
Firearms and ammunition	16,042	17,840	34,112,000
Fire extinguishers, chemical	300	215	754,000
Fireworks	1,567	517	2,269,000
Flags, banners, regalia, society badges and emblems	4,522	1,173	8,114,000
Flavoring extracts	2,634	1,060	8,828,000
Flax and hemp, dressed	216	1,147	467,000
Four-mill and gristmill products	66,054	853,584	883,584,000
Food preparations	20,965	55,166	125,331,000
Foundry and machine-shop products	615,485	869,305	1,228,475,000
Foundry supplies	710	4,995	2,298,000
Fuel, manufactured	112	1,290	311,000
Fur goods	16,152	2,120	55,938,000
Furnishing goods, men's	43,935	12,116	87,710,000
Furniture and refrigerators	144,140	221,451	239,886,000
Furs, dressed	1,472	2,103	2,391,000
Galvanizing	1,689	1,367	7,338,000
Gas and electric fixtures and lamps and reflectors	22,906	15,862	45,057,000
Gas, illuminating and heating	51,007	128,350	166,814,000
Glass	72,573	128,532	92,095,000
Glass, cutting, staining, and ornamenting	11,090	4,897	16,101,000
Gloves and mittens, leather	12,950	2,889	23,631,000
Glucose and starch	5,827	28,257	48,799,000
Glue	3,840	15,596	13,718,000
Gold and silver, leaf and foil	1,553	259	2,630,000
Gold and silver, reducing and refining, not from the ore	690	1,735	23,612,000
Graphite and graphite refining	262	1,472	1,140,000
Grease and tallow	5,504	14,613	23,419,000
Grindstones	1,485	5,700	1,688,000
Haircloth	621	995	2,230,000
Hairwork	4,383	218	5,135,000
Hammocks	325	157	578,000
Hand stamps and stencils and brands	2,539	903	3,673,000
Hat and cap materials	2,618	2,922	8,236,000
Hats and caps, other than felt, straw, and wool	7,609	990	13,689,000
Hats, fur felt	27,091	19,245	47,865,000
Hats, straw	9,704	3,482	21,424,000
Hones and whetstones	173	677	268,000
Horseshoes, not made in steel works or rolling mills	360	1,045	1,015,000
Hosiery and knit goods	136,130	103,709	200,143,000
House-furnishing goods, not elsewhere specified	5,916	9,328	18,509,000
Ice, manufactured	21,107	317,789	42,953,000
Ink, printing	1,854	5,857	8,865,000
Ink, writing	824	169	2,505,000
Instruments, professional and scientific	6,175	4,856	10,504,000

SUMMARY OF MANUFACTURES: BY SPECIFIED INDUSTRIES, 1909.—Continued.

INDUSTRY.	Persons Engaged.	Primary Horse-Power.	Value of Products.
Iron and steel, blast furnaces	43,061	1,173,422	391,429,000
Iron and steel, steel works and rolling mills	260,762	2,100,978	985,723,000
Iron and steel, bolts, nuts, washers, and rivets, not made in steel works or rolling mills	12,395	22,113	24,485,000
Iron and steel, doors and shutters	1,816	1,997	3,006,000
Iron and steel forgings	9,193	27,803	20,293,000
Iron and steel, nails and spikes, cut and wrought, including wire nails, not made in steel works or rolling mills	3,239	7,723	8,192,000
Iron and steel pipe, wrought	7,309	20,656	30,886,000
Jewelry	36,992	11,204	80,350,000
Jewelry and instrument cases	2,441	527	3,116,000
Kaolin and ground earths	2,351	20,920	4,681,000
Labels and tags	2,880	1,589	4,670,000
Lapidary work	886	679	9,173,000
Lard, refined, not made in slaughtering and meat-packing establishments	515	723	10,326,000
Lasts	2,029	3,386	4,159,000
Lead, bar, pipe, and sheet	1,044	3,179	9,145,000
Leather goods	43,525	28,148	104,719,000
Leather, tanned, curried and finished	67,100	148,140	327,874,000
Lime	15,659	27,671	17,952,000
Liquors, distilled	8,328	46,120	204,699,000
Liquors, malt	66,725	347,726	374,730,000
Liquors, vinous	2,726	6,771	13,121,000
Locomotives, not made by railroad companies	16,945	35,102	31,582,000
Looking-glass and picture frames	7,470	5,330	13,475,000
Lumber and timber products	784,989	2,840,082	1,156,129,000
Malt	2,237	26,441	38,252,000
Marble and stone work	77,275	187,686	113,093,000
Matches	4,220	6,224	11,353,000
Mats and matting	1,040	1,433	2,432,000
Mattresses and spring beds	14,109	17,689	35,783,000
Millinery and lace goods	46,301	7,918	85,894,000
Mineral and soda waters	22,060	19,392	43,508,000
Mirrors	3,509	3,862	9,571,000
Models and patterns, not including paper patterns	5,450	5,486	8,868,000
Moving pictures	718	486	4,206,000
Mucilage and paste	901	2,335	4,918,000
Musical instruments and materials not specified	2,269	1,423	3,228,000
Musical instruments, pianos and organs, and materials	41,882	41,623	89,790,000
Needles, pins and hooks and eyes	4,978	4,542	6,694,000
Oakum	129	289	338,000
Oil, castor	70	385	905,000
Oil, cotton seed and cake	21,273	192,342	147,868,000
Oil, essential	408	1,218	1,737,000
Oil, linseed	1,753	13,211	36,739,000
Oil, not elsewhere specified	3,144	5,772	30,865,000
Oilcloth and linoleum	5,557	16,125	23,339,000
Oleomargarine	773	2,408	8,148,000
Optical goods	7,809	5,725	11,735,000
Paint and varnish	21,896	56,162	124,889,000
Paper and wood pulp	81,473	1,304,255	267,657,000
Paper goods, not elsewhere specified	22,385	27,067	55,171,000
Paper patterns	1,755	751	2,611,000
Patent medicines and compounds and druggists' preparations	41,101	25,659	141,942,000
Paving materials	1,731	5,757	6,229,000
Peanuts, grading, roasting, cleaning and shelling	2,177	2,827	9,737,000
Pencils, lead	4,513	3,448	7,379,000
Pens, fountain, stylographic and gold	1,820	569	4,739,000
Pens, steel	755	244	577,000
Petroleum, refining	16,640	90,268	236,998,000
Phonographs and graphophones	5,928	6,371	11,726,000
Photographic apparatus and materials	6,596	8,637	22,561,000
Photo-engraving	7,277	2,638	11,624,000
Pipes, tobacco	3,090	1,506	5,312,000
Pottery, terra-cotta and fire-clay products	61,022	110,017	76,119,000
Printing and publishing	388,466	297,763	737,876,000

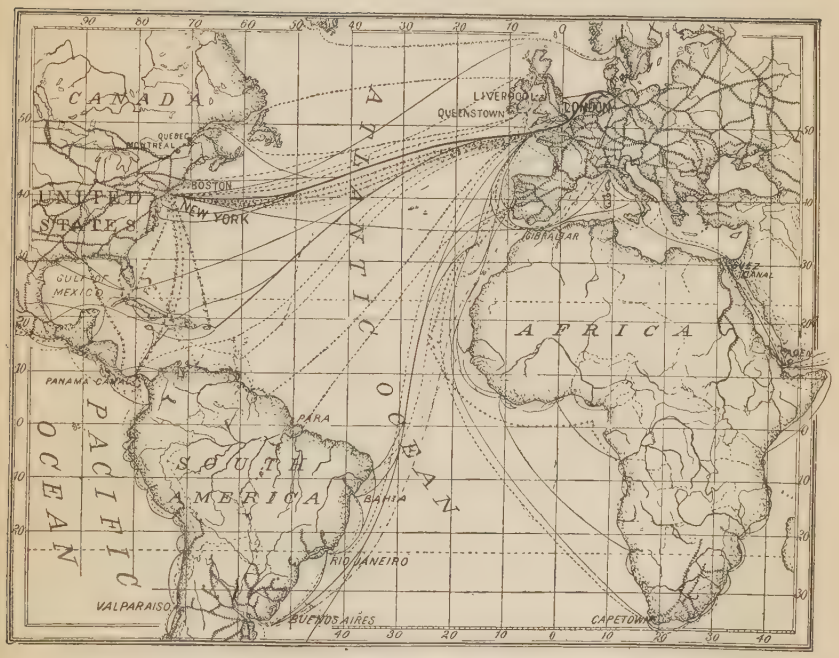
SUMMARY OF MANUFACTURES: BY SPECIFIED INDUSTRIES, 1909. – Continued.

INDUSTRY.	Persons Engaged.	Primary Horse-Power.	Value of Products.
Pulp goods	882	3,125	1,770,000
Pumps, not including steam pumps	2,623	4,214	5,583,000
Rice, cleaning and polishing	1,777	19,519	22,371,000
Roofing materials	3,530	9,431	19,204,000
Rubber goods, not elsewhere specified	31,284	79,062	128,436,000
Rules, ivory and wood	127	167	144,000
Safes and vaults	4,060	5,546	8,491,000
Salt	5,580	27,263	11,328 000
Sand and emery paper and cloth	779	3,351	4,358,000
Saws	5,757	11,852	11,536,000
Scales and balances	4,275	6,183	8,786,000
Screws, machine	1,863	3,319	3,014,000
Screws, wood	3,758	5,618	6,199,000
Sewing machines, cases and attachments	20,556	19,426	28,262,000
Shipbuilding, including boatbuilding	44,949	88,063	73,360,000
Shoddy	2,320	13,820	7,446,000
Show cases	3,943	4,746	7,167,000
Signs and advertising novelties	7,277	3,790	13,546,000
Silk and silk goods, including throwsters	105,238	97,947	196,912,000
Silverware and plated ware	18,774	15,183	42,229,000
Slaughtering and meat packing	108,716	208,707	1,370,568,000
Smelting and refining, copper	16,832	158,126	378,806,000
Smelting and refining, lead	8,059	26,954	167,406,000
Smelting and refining, zinc	7,156	21,457	34,206,000
Smelting and refining, not from the ore	2,596	10,705	28,072,000
Soap	18,393	28,360	111,358,000
Soda-water apparatus	2,399	2,894	6,556,000
Sporting and athletic goods	5,993	3,243	11,052,000
Springs, steel, car and carriage	3,573	7,349	9,005,000
Stationery goods, not elsewhere specified	7,938	6,842	16,647,000
Statuary and art goods	2,172	462	3,442,000
Steam packing	4,968	11,129	12,160,000
Stereotyping and electrotyping	3,661	4,076	6,384,000
Stoves and furnaces, including gas and oil stoves	42,921	45,524	78,853,000
Sugar and molasses, not including beet sugar	15,658	160,603	279,249,000
Sulphuric, nitric and mixed acids	2,582	6,494	9,884,000
Surgical appliances and artificial limbs	5,805	5,752	12,399,000
Tin plate and terneplate	5,846	8,154	47,970,000
Tin foil	762	1,699	3,419,000
Tobacco manufactures	197,637	28,514	416,695,000
Toys and games	6,072	5,323	8,264,000
Turpentine and resin	44,524	4,129	25,295,000
Type-founding and printing materials	2,597	1,948	4,703,000
Typewriters and supplies	12,101	6,845	19,719,000
Umbrellas and canes	6,505	2,413	15,864,000
Upholstering materials	4,777	17,456	13,054,000
Vault lights and ventilators	453	234	957,000
Vinegar and cider	3,073	16,681	8,448,000
Wall paper	4,746	5,680	14,449,000
Wall plaster	5,624	25,892	12,804,000
Washing machines and clothes wringers	2,294	3,351	5,825,000
Waste	2,129	4,286	11,398,000
Wheelbarrows	775	1,486	1,625,000
Whips	1,946	1,321	3,949,000
Windmills	2,742	3,301	6,677,000
Window shades and fixtures	4,770	5,737	18,571,000
Wire	19,945	71,959	84,486,000
Wirework, including wire rope and cable	14,994	20,131	41,938,000
Wood distillation, not including turpentine and resin	3,095	9,854	9,737,000
Wood carpet	221	269	490,000
Wood preserving	2,875	10,647	14,099,000
Wood, turned and carved	16,243	48,447	22,199,000
Wood pulling	759	1,366	5,181,000
Wool scouring	1,262	6,785	3,289,000
Woolen, worsted, and felt goods, and wool hats	175,176	362,209	435,979,000
All other industries*	132	136	390,000
Total	7,678,578	18,680,776	$20,672,052,000

* Includes the following industries: Millstones; ordnance and accessories; pulp, from fibre other than wood; straw goods, not elsewhere specified; and whalebone cutting.

CHAPTER V.

COMMERCE.



PRINCIPAL TRADE ROUTES ON THE ATLANTIC OCEAN.

AREA OF THE LARGEST LAKES.

	Square Miles.
Caspian Sea (85 feet below the level of the Black Sea)	169,890
Lake Superior (N. Am.)	32,430
Victoria Nyanza (Afr.)	28,960
Lake Aral (As.)	26,260
Lake Huron (N. Am.)	23,940
Lake Michigan (N. Am.)	23,940
Tanganyika (Afr.)	13,740
Lake Baikal (As.)	13,130
Nyassa (Afr.)	10,230
Lake Tsad (Afr.)	9,800
Lake Erie (N. Am.)	9,650
Lake Winnipeg (N. Am.)	9,270
Great Slave Lake (N. Am.)	8,110
Great Bear Lake (N. Am.)	8,110
Lake Balkash (As.)	8 110
Lake Ontario (N. Am.)	7,720
Lake Ladoga (Russia)	6,950
Maracaibo Lake	6,490
Great Salt Lake (N. Am.)	5,600

COMMERCIAL AND FINANCIAL STATISTICS OF THE PRINCIPAL COUNTRIES OF THE WORLD.

Country.	Area.	Population in 1910 or on latest available date.	Population per square mile.	Foreign commerce.						
				Year.	Imports of merchandise.	Imports from United States.		Exports of merchandise.	Exports to United States.	
	Sq. miles.				*Dollars.*	*Dollars.*	*Per cent.*	*Dollars.*	*Dollars.*	*Per cent.*
Argentina	1,139,196	6,989,000	6.14	1910	339,459,000	46,724,000	13.8	359,584,000	24,437,000	6.8
Australasia:										
Commonwealth of Australia [1,2,3]	2,974,581	4,455,000	1.50	1910	292,060,000	31,607,000	10.8	349,591,000	7,602,000	2.2
New Zealand [1,3]	104,751	1,008,000	9.62	1910	82,982,000	6,812,000	8.2	107,940,000	2,694,000	2.5
Austria-Hungary [4,5]	261,033	51,304,000	196.54	1910	579,129,000	48,095,000	8.3	490,977,000	16,515,000	3.4
Austria (including Bosnia and Herzegovina)	[6] 135,606	[6] 30,463,000	224.82	1910						
Hungary	[6] 125,427	[6] 20,841,000	166.16	1910						
Belgium [4,5]	11,373	7,517,000	660.95	1910	823,137,000	44,619,000	5.4	657,634,000	22,609,000	3.4
Kongo, Belgian	919,999	20,000,000	21.74	1910	7,111,000	22,000	.3	12,369,000		
Bolivia	567,643	2,268,000	4.00	1910	24,889,000	[7] 704,000	2.8	38,567,000		
Brazil [8]	3,291,416	21,115,000	6.42	1910	235,575,000	30,254,000	12.8	310,006,000	112,184,000	36.2
Bulgaria [5,9]	37,199	4,329,000	116.38	1910	34,230,000	165,000	.5	24,907,000	216,000	.9
Canada [4,5]	3,729,675	7,082,000	1.90	[10] 1911	461,951,000	284,935,000	61.7	274,317,000	103,922,000	37.9
Central American States:										
Costa Rica	18,691	380,000	20.33	1910	8,153,000	4,182,000	51.3	8,645,000	5,206,000	60.2
Guatemala	43,641	2,000,000	45.83	1909	5,251,000	1,745,000	33.2	10,079,000	[7] 3,122,000	31.0
Honduras	44,274	553,000	12.49	1910	3,019,000	2,060,000	68.2	2,572,000	2,255,000	87.7
Nicaragua	49,532	600,000	12.11	1909	3,500,000	[7] 1,475,000	42.1	3,600,000	[7] 1,098,000	30.5
Panama [11]	33,776	387,000	11.46	1910	10,043,000	5,628,000	56.0	1,769,000	1,508,000	85.3
Salvador	8,170	1,707,000	208.94	1910	3,745,000	1,347,000	36.0	7,298,000	2,280,000	31.2
Chile [4,5]	292,743	3,500,000	11.96	1910	108,582,000	13,370,000	12.8	120,022,000	24,681,000	20.6
China [3,4]	4,277,170	336,042,000	78.57	1910	310,956,000	16,182,000	5.2	248,498,000	21,069,000	8.5
Colombia	435,278	4,804,000	11.04	1910	17,026,000	[7] 4,637,000	27.2	17,625,000	[7] 7,703,000	43.7
Cuba [12]	45,881	2,159,000	47.06	[10] 1911	108,007,000	57,053,000	52.8	128,542,000	112,834,000	87.8
Denmark [4,12]	15,046	2,757,000	183.24	[10] 1910	170,021,000	16,320,000	9.6	146,884,000	9,572,000	6.5
Ecuador	118,627	1,500,000	12.64	1910	7,026,000	2,108,000	30.0	13,057,000	3,644,000	27.9
Egypt [3,13]	383,899	11,287,000	29.40	1910	116,422,000	2,728,000	2.3	143,072,000	9,352,000	6.5
Sudan	950,000	2,600,000	2.74	1910	9,364,000	17,000	.2	4,720,000	159,000	3.4
France [4,5]	207,129	39,602,000	191.19	1910	1,384,453,000	118,526,000	8.6	1,203,124,000	88,016,000	7.3
Algeria [4,5]	343,629	5,232,000	15.23	1910	99,659,000	695,000	.7	99,825,000	535,000	.5
Tunis	64,633	2,229,000	34.49	1910	20,361,000	363,000	1.8	23,237,000	43,000	.2
French Indo-China [4,5]	256,255	16,990,000	66.30	1909	48,202,000	632,000	1.3	46,615,000		
French colonies, n. e. s. [3,4]	3,576,676	25,816,000	7.22	1909	51,156,000	3,049,000	6.0	50,791,000	726,000	1.4

German Empire	[6] 208,794	[6] 64,926,000	310.96	1910						
German Customs Union [4, 5]	209,793	65,186,000	310.72	1910	2,126,322,000	282,649,000	13.3	1,778,969,000	150,583,000	8.5
German colonies [4, 5, 14]	1,026,022	13,993,000	13.64	1909	32,836,000	[7] 314,000	1.0	19,551,000	[7] 1,044,000	5.3
Greece [4, 5]	24,964	2,632,000	105.43	1909	26,547,000	903,000	3.4	19,626,000	1,686,000	8.6
Haiti	11,072	2,030,000	183.35	[15] 1910	6,101,000	4,237,000	69.3	11,008,000	[7] 526,000	4.8
India, British [3, 16]	1,766,597	315,133,000	178.36	[10] 1911	419,686,000	11,323,000	2.7	664,676,000	43,312,000	6.5
Italy [4, 5]	110,688	34,687,000	313.38	1910	626,473,000	70,059,000	11.2	401,436,000	50,913,000	12.7
Eritrea (Massaua)	45,795	450,000	9.83	1909	2,288,000	5,000	.2	974,000		
Japan (including Pescadores, but excluding Formosa and Sakhalin) [4, 12]	147,699	50,752,000	343.67	1910	231,188,000	27,240,000	11.8	226,636,000	71,486,000	31.5
Formosa [4, 17]	13,503	3,392,000	251.20	1910	24,363,000	1,348,000	5.5	29,842,000	2,527,000	8.5
Korea [4, 12]	84,106	12,934,000	153.78	1910	19,812,000	1,596,000	8.1	9,917,000	152,000	1.5
Liberia	36,834	1,500,000	40.72	1908	966,000	[7] 50,000	5.2	884,000	[7] 1,000	.1
Mexico [1, 18]	767,323	15,063,000	19.63	[19] 1911	102,506,000	56,318,000	54.9	146,289,000	111,799,000	76.4
Morocco	169,591	5,000,000	29.48	1910	11,826,000	87,000	.7	7,224,000	184,000	2.6
Netherlands [4, 5]	12,741	5,858,000	459.78	1909	1,249,423,000	116,826,000	9.4	984,397,000	40,010,000	4.1
Dutch East Indies [4, 12, 20]	739,548	37,957,000	51.32	1909	104,537,000	1,764,000	1.7	173,543,000	7,405,000	4.3
Dutch possessions in America	50,282	144,000	2.86	1909	4,194,000	[7] 1,311,000	31.3	2,983,000	[7] 1,338,000	44.9
Norway [4]	124,705	2,393,000	19.19	1910	107,761,000	7,714,000	7.2	75,737,000	6,317,000	8.3
Paraguay	97,722	800,000	8.19	1910	6,248,000	310,000	5.0	4,786,000	[7] 27,000	.6
Persia [4]	635,135	9,500,000	14.96	[21] 1911	49,904,000	30,000	6.0	38,669,000	519,000	1.3
Peru	683,321	4,560,000	6.67	1909	20,919,000	4,118,000	19.7	31,597,000	7,278,000	23.0
Portugal (including Madeira and Azores) [4, 5]	35,499	5,423,000	152.76	1909	69,939,000	[5] 7,472,000	10.7	33,350,000	[6] 934,000	2.8
Portuguese colonies	808,107	8,580,000	10.53	1908–9	[22] 31,807,000	[7] 2,709,000	8.5	[22] 28,448,000	[7] 222,000	.8
Roumania [4, 5]	50,715	6,966,000	137.36	1909	71,082,000	[7] 603,000	.8	89,756,000	[7] 36,000	.04
Russia [4, 5]	8,460,246	160,748,000	19.00	1909	468,763,000	29,795,000	6.4	735,252,000	5,920,000	.8
Finland	144,249	3,059,000	21.21	1909	70,721,000			49,112,000		
Santo Domingo [4]	18,756	674,000	35.94	1910	6,409,000	3,885,000	60.6	10,850,000	7,661,000	70.6
Servia [4, 5]	18,650	2,922,000	156.67	1910	16,146,000	202,000	1.3	18,989,000	908,000	4.8
Siam [23]	195,000	7,000,000	35.90	[10] 1911	25,375,000	647,000	2.6	40,542,000	19,000	.1
Spain [1, 5]	194,794	19,503,000	100.12	1910	180,007,000	19,840,000	11.0	174,693,000	11,886,000	6.8
Sweden [1, 12]	172,920	5,522,000	31.93	1909	165,304,000	12,855,000	7.8	126,759,000	4,283,000	3.4
Switzerland [4, 5]	15,951	3,753,000	235.30	1910	336,789,000	13,283,000	3.9	230,803,000	27,779,000	12.0
Turkey (including Samos) [24]	1,153,500	24,867,000	21.56	[25] 1909	134,797,000	1,762,000	1.3	79,076,000	3,016,000	3.8
Crete	3,327	344,000	103.40	1908	4,067,000	15,000	.4	3,546,000	73,000	2.1
Union of South Africa [26]	473,184	5,958,000	12.59	1910	165,293,000	17,826,000	10.8	263,857,000	1,955,000	.7
United Kingdom [3, 4]	121,316	45,366,000	373.94	1910	3,300,738,000	572,381,000	17.3	2,094,467,000	154,042,000	7.4
British colonies, n. e. s. [1]	2,279,202	39,230,000	17.21	1909	405,825,000	48,774,000	12.0	377,766,000	38,681,000	10.2
United States (including Alaska, Hawaii, and Porto Rico) [3, 4]	3,627,557	93,402,000	25.75	[19] 1911	1,527,966,000			2,013,549,000		
Philippine Islands [4, 13, 27]	115,026	8,277,000	71.96	[19] 1911	49,834,000	19,484,000	39.1	39,779,000	16,717,000	42.0
Porto Rico	[6] 3,435	[6] 1,118,000	325.47	1911						
Uruguay [2, 8]	72,172	1,112,000	15.41	1910	42,797,000	[7] 4,877,000	11.4	43,333,000	[7] 4,611,000	10.6
Venezuela	363,822	2,686,000	7.39	[19] 1911	15,475,000	4,025,000	26.0	18,706,000	6,098,000	32.6
Total	49,756,607	1,732,916,000	34.83		17,626,503,000	2,094,691,000	11.8	16,007,244,000	1,365,930,000	8.5

COMMERCIAL AND FINANCIAL STATISTICS OF THE PRINCIPAL COUNTRIES OF THE WORLD—Continued.

Country.	Length of railways.		Telegraphs.			Post offices.	Miles of postal routes.	Miles of mail service performed.	Domestic money and postal orders sent.		Foreign money orders sent.	
	Date.	Miles.	Date.[29]	Miles of line.	Miles of wire.				Number.	Value.	Number.	Value.
										Dollars.		*Dollars.*
Argentina	1910	17,392	1910	37,905	100,336	2,953	43,336	14,613,700	244,469	8,632,122	16,043	292,807
Australasia:												
Commonwealth of Australia	[19] 1910	17,432	1909	42,298	89,468	7,724	126,601	33,586,165	7,382,840	38,282,240	184,231	2,384,479
New Zealand	[10] 1910	2,746	[10] 1910	10,901	34,788	2,206	.....	.....	383,283	8,954,038	155,457	2,269,161
Austria-Hungary	1910	27,571	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Austria (including Bosnia and Herzegovina)	.....	.....	1909	30,271	147,950	10,077	141,168	83,381,280	30,927,440	298,742,785	5,480,764	63,604,808
Hungary	.....	.....	1909	15,554	88,794	5,986	62,553	51,019,710	20,413,297	214,490,113	4,359,116	50,965,575
Belgium	1910	[30] 5,288	1909	4,617	24,370	1,562	5,551	65,180,291	4,147,817	67,864,269	685,750	8,852,489
Kongo, Belgian	1910	575	1910	.....	1,685	66	13,875	902,639	765	28,501	3,539	115,178
Bolivia	1911	635	1909	3,111	4,153	198	.....	.....	.....	.....	.....	.....
Brazil	1910	13,279	1909	36,199	73,124	[31] 3,246	.....	.....	.....	.....	.....	.....
Bulgaria	1910	1,176	1910	3,688	7,929	2,070	14,654	4,475,685	375,531	5,395,241	174,125	5,656,615
Canada	1910	24,731	1910	[32] 36,517	152,739	[33] 12,887	.....	.....	.....	[33] 41,595,206	.....	[33] 19,371,957
Central American States: [34]												
Costa Rica	1910	427	1910	.....	1,472	199	.....	.....	.....	.....	.....	.....
Guatemala	1910	450	1910	4,209	.....	281	.....	.....	.....	.....	.....	.....
Honduras	1910	106	1910	.....	3,220	264	.....	.....	.....	.....	.....	.....
Nicaragua	1910	171	1910	.....	3,637	135	.....	.....	.....	.....	.....	.....
Panama	1910	202	.....	.....	.....	96	.....	.....	.....	.....	.....	.....
Salvador	1910	97	1909	.....	2,491	96	1,848	36,601	.....	.....	617	2,838
Chile	1910	3,573	1909	.....	24,661	1,068	28,752	7,464,518	2,510,786	4,754,350	61,926	648,931
China	1911	5,404	1909	26,413	43,011	[35] 5,357	.....	.....	.....	.....	.....	.....
Colombia	1910	614	1909	10,676	.....	500	.....	.....	.....	.....	.....	.....
Cuba	1910	2,123	1910	5,065	6,184	487	[36] 5,324	2,545,828	.....	.....	.....	.....
Denmark	1910	2,141	[10] 1911	2,264	7,980	1,557	6,357	9,643,414	[35] 4,318,456	47,791,102	[35] 243,520	3,173,081
Ecuador	1910	350	1910	2,608	.....	81	.....	.....	.....	.....	.....	.....
Egypt	1911	3,639	1909	[37] 7,895	22,211	1,645	6,399	6,055,257	771,569	21,108,101	151,694	3,209,253
France	1910	30,686	1909	111,149	416,270	13,631	78,221	371,898,627	57,708,580	479,002,355	1,792,076	18,762,155
Algeria	1910	2,049	1909	9,359	24,393	650	8,137	7,988,374	2,080,152	73,149,778	34,253	507,892
Tunis	1910	952	1910	2,577	9,944	404	5,090	2,456,670	265,189	4,903,563	220,012	2,983,777
French Indo-China	1910	1,103	1910	8,753	15,183	310	20,282	6,691,189	164,780	4,190,329	88,686	1,872,161
French Colonies, n. e. s	1910	1,801	1908	10,556	21,897	519	66,165	5,777,588	129,374	3,685,775	94,781	2,536,526

German Empire	1910	37,991	1910	139,680	420,103	50,575	93,073	.....	201,256,823	2,624,323,444	4,357,705	47,326,020
German Colonies	1910	1,841	1909	4,973	5,989	183	.....	.....	401,919	19,002,307	(38)	(38)
Greece	1910	982	1909	5,039	9,653	1,072	.....	.....	177,166	3,230,285	33,834	414,155
Haiti	1910	64	1910	124	.....	80	2,371	102,944	.....	.....	.....	.....
India, British	[10] 1911	32,399	[10] 1910	72,746	287,266	[39] 19,411	158,806	115,619,120	23,216,880	121,676,815	162,577	3,007,900
Italy, including Eritrea	[10] 1911	[40] 10,689	1909	[41] 34,655	182,405	10,287	51,516	62,556,431	19,513,276	326,879,944	426,948	6,147,508
Japan (including Pescadores but excluding Formosa)	[10] 1910	5,130	[10] 1910	[42] 23,307	102,126	6,943	67,549	77,088,053	14,603,866	90,011,441	20,804	313,005
Formosa	[10] 1910	271	[10] 1910	596	1,864	133	(43)	(43)	(43)	(43)	(43)	(43)
Korea	[10] 1911	674	[10] 1911	3,397	7,953	439	21,273	5,285,466	418,345	7,871,520	1,423	16,555
Luxemburg	1910	318	1910	436	1,281	123	812	1,146,492	243,565	5,474,871	368,994	7,548,876
Mexico	1911	15,358	1910	22,452	46,139	[44] 2,843	55,258	24,426,137	1,546,203	25,414,233	121,812	1,982,408
Netherlands	1910	1,985	1910	4,676	22,918	1,483	9,911	20,946,134	5,594,230	32,760,663	458,973	3,658,831
Dutch East Indies	1909	[45] 1,552	1909	9,007	13,126	1,682	11,254,550	16,634,632	300,497	4,245,899	68,951	812,924
Dutch Possessions in America	1909	104	.....	.....	.....	17	.....	.....	4,745	6,827,803	10,270	258,990
Norway	1910	1,921	1910	6,475	12,835	3,307	46,533	11,874,447	726,674	10,650,832	255,185	1,966,881
Paraguay	1911	232	1910	2,000	.....	385	.....	.....	.....	.....	.....	.....
Persia	1909	34	1909	6,312	10,754	218	.....	.....	.....	.....	.....	.....
Peru	1910	1,628	1910	7,072	.....	669	.....	.....	22,736	7,995,232	.....	.....
Portugal	1910	1,808	1908	5,795	13,484	3,861	19,675	12,221,657	744,854	10,753,395	45,296	471,139
Portuguese Colonies	1909	936	1909	5,059	5,928	735	26,854	2,745,792	21,586	317,396	29,434	570,440
Roumania	1910	2,239	[10] 1910	4,754	11,999	[33] 2,970	64,402	16,724,615	1,578,782	11,915,387	377,125	3,891,049
Russia	1910	46,522	1909	[46] 121,227	427,246	14,963	206,629	92,053,486	36,072,706	959,530,049	595,496	10,166,307
Finland	1910	2,275	.....	(47)	(47)	2,045	(47)	(47)	(47)	(47)	(47)	(47)
Santo Domingo	1910	150	1910	1,029	.....	81	.....	.....	.....	.....	.....	.....
Servia	1910	494	1909	2,200	6,435	1,505	2,084	1,000,642	446,348	7,227,086	39,305	634,350
Siam	1911	677	1909	4,527	6,604	179	.....	.....	.....	.....	.....	.....
Spain	1910	9,217	1909	22,999	52,671	5,272	22,909	.....	.....	.....	.....	.....
Sweden	1910	8,599	1910	6,383	20,020	4,053	39,974	28,288,436	6,390,849	53,251,751	349,634	3,226,687
Switzerland	1910	2,921	1910	2,282	16,169	4,193	7,480	18,379,165	6,543,698	124,833,896	1,709,235	14,308,676
Turkey	1910	967	1910	28,251	47,683	[48] 900	30,175	7,026,300	861,407	13,792,380	7,913	85,461
Crete	.....	.....	1909	229	.....	[49] 28	.....	.....	36,339	546,837	7,008	98,659
Union of South Africa	1910	7,586	1909	19,520	58,564	2,365	.....	14,101,700	.....	.....	[50] 275,688	[50] 6,403,131
United Kingdom	1910	23,387	[10] 1910	[51] 58,350	[51] 1,170,125	[33] 24,062	.....	.....	131,617,887	413,724,376	771,744	11,874,347
British Colonies, n. e. s.	1910	5,554	1910	28,177	.....	2,312	.....	.....	.....	.....	.....	.....
United States	[19] 1910	[52] 241,004	1911	[53] 219,219	1,487,345	[54] 59,239	435,489	569,077,851	81,146,233	578,111,005	4,820,224	109,604,639
Philippine Islands	[19] 1911	606	1911	[32] 4,303	6,687	[44] 556	.....	.....	151,357	4,890,835	(38)	(38)
Porto Rico	[19] 1911	340	1911	590	1,400	(54)	(54)	(54)	(54)	(54)	(54)	(54)
Uruguay	1910	1,472	1910	.....	4,849	[35] 1,018	.....	.....	.....	.....	.....	.....
Venezuela	1910	542	1910	.....	4,902	[35] 282	.....	.....	.....	.....	.....	.....
Total	.....	637,282	.....	1,306,726	5,794,413	306,724	13,251,436	1,771,017,036	665,463,299	6,787,829,550	29,053,168	421,998,621

COMMERCIAL AND FINANCIAL STATISTICS OF THE PRINCIPAL COUNTRIES OF THE WORLD—Continued.

Country.	Revenue and expenditure.			Debt.							
	Year.	Revenue.[55]	Expenditure.[55]	Year.	Funded.		Unfunded, including floating, noninterest bearing, etc.		Total in United States currency.	Rates of interest.	Interest and other annual charges.
					Currency.	Amount.	Currency.	Amount.			
		Dollars.	*Dollars.*						*Dollars.*	*Per ct.*	*Dollars.*
Argentina	1911	136,915,000	137,394,600	1910	£ Pesos gold Paper currency	102,465,000 92,505,000 121,425,000			639,516,000	4 - 7	30,600,000
Australasia:											
Commonwealth of Australia	1909-10	[56] 36,496,000	[56] 36,496,000								
Australia, States	1909-10	[56] 179,850,000	[56] 212,947,000	1910	£	243,366,000	£	14,258,000	1,263,726,000	3 - 4	50,849,000
New Zealand	1909-10	[56] 55,150,000	[56] 54,540,000	1910	£	74,891,000	£	100,000	364,942,000	3 - 4	11,668,000
Austria-Hungary	1910	90,931,000	87,799,000	1910	Kronen	5,219,463,000	Kronen	980,000	1,059,760,000	3 - 5	42,752,000
Austria	1911	572,157,000	572,094,000	1910	Kronen	6,876,900,000	Kronen	60,000,000	1,408,191,000	3 - 5	54,526,000
Hungary	1911	339,519,000	339,509,000	1909	Kronen	4,803,304,000	Kronen	908,784,000	1,159,554,000	3 - 5	58,887,000
Belgium	1911	127,134,000	127,026,000	1910	Francs	3,580,860,000	Francs	146,675,000	719,414,000	2½- 3	28,321,000
Kongo, Belgian	1911	8,222,000	11,980,000	1910	Francs	214,910,000			43,627,000		
Bolivia	1910	5,271,000	5,407,000	1911	£ Bolivianos	2,000,000 4,350,000			11,427,000	5½- 6	754,000
Brazil	1910	[56] 174,010,000	[56] 192,415,000	1911	£ Francs Milreis paper	77,332,000 240,000,000 591,751,000	Milreis paper	617,672,000	815,032,000	4 - 5	28,639,000
Bulgaria	1910	33,244,000	33,211,000	1910	Francs	516,282,000	Francs	45,000,000	108,327,000	4½- 6	7,485,000
Canada	1910	[56] 101,504,000	[56] 79,412,000	1910	Dollars	262,269,000	Dollars	208,394,000	470,663,000	2½- 4	14,898,000
Central American States:											
Costa Rica	1909-10	[56] 5,334,000	[56] 5,334,000	1910	£ Colones	1,617,000 6,514,000	Colones	4,538,000	13,009,000	4 - 5	628,000
Guatemala	1910	[56] 3,094,000	[56] 2,758,000	1910	Pesos gold	14,683,000	Pesos currency	71,976,000	18,488,000	4 - 8	1,716,000
Honduras	1909-10	[56] 1,568,000	[56] 1,620,000	1910	£	22,934,000	Pesos silver	4,053,000	113,140,000	5 -10	220,000
Nicaragua	1910	[56] 1,518,000	[56] 1,205,000	1910	£	916,000	U. S. dollars Pesos paper	175,000 51,079,000	9,742,000	6	394,000
Panama	1910	[56] 3,371,000	[57] 3,439,000	1911			U. S. dollars	125,000	125,000	7	9,000
Salvador	1910	[56] 5,301,000	[56] 5,282,000	1911	U. S. dollars Colones, silver	8,039,000 3,620,000	U. S. dollars Colones, silver	2,627,000 2,587,000	13,149,000	2 - 6	1,317,000
Chile	1910	[56] 64,049,000	[56] 73,943,000	1911	£ Pesos gold Pesos paper	25,259,000 6,094,000 28,593,000	Pesos paper	150,872,000	164,845,000	4½- 5	6,769,000
China	1911	193,795,000	229,031,000	1911	£ Francs	111,584,000 486,000,000			636,822,000	4 - 7	33,696,000
Colombia	1911	9,780,000	11,393,000	1911	£	4,532,000	Dollars	3,290,000	25,259,000	3 - 6	1,440,000
Cuba	1910	[56] 41,615,000	[56] 40,593,000	1910	Dollars	62,083,000			62,083,000	4½- 6	4,339,000
Denmark	1910	[56] 36,247,000	[56] 35,692,000	1910	Kroner	301,754,000			80,870,000	3 - 4	2,580,000
Ecuador	1909	[56] 7,967,000	[56] 7,575,000	1910	Sucres	43,511,000			21,175,000	4 -10	1,242,000

Egypt	1911	76,816,000	74,145,000	1911	£	94,972,000			462,182,000	3 - 4	17,651,000
France	1911	846,631,000	846,587,000	1911	Francs	31,049,607,000	Francs	1,493,351,000	6,280,791,000	2½- 3	186,016,000
Algeria	1911	27,898,000	27,897,000	1909	Francs	53,313,000			10,289,000	3½	3,291,000
Tunis	1910	12,736,000	12,735,000	1907	Francs				45,196,000		2,261,000
French Indo-China	1909	23,862,000	23,862,000	1910	Francs	341,094,000			65,831,000	2½- 3½	2,106,000
French Colonies, n. e. s.	1909	29,264,000	28,976,000	1910	Francs	296,666,000			57,257,000	3 - 4	2,314,000
German Empire	1911-12	696,100,000	696,100,000	1910	Marks	4,556,633,000	Marks	589,653,000	1,224,808,000	3 - 4	68,008,000
German States	1910	1,345,865,000	1,333,012,000	1910	Marks	14,728,746,000	Marks	696,484,000	3,671,205,000	3 - 4	156,147,000
German Colonies	1911	21,910,000	28,032,000	1910	Marks	84,580,000			20,130,000		714,000
Greece	1910	27,321,000	27,025,000	1910	£	30,093,000			163,192,000	2½- 5	5,966,000
				1909	Drachmas	86,760,000					
Haiti	1910-11	5,019,000	4,978,000	1911	Francs	127,046,000	U. S. dollars	12,019,000	48,912,000	2½- 6	2,563,000
					U. S. dollars	12,373,000					
India, British	1910-11	391,939,000	374,958,000	1909	£	250,678,000	Rupees	226,230,000	1,294,287,000	3 - 3½	50,119,000
Italy	1911-12	479,431,000	469,467,000	1910	Lire	10,055,387,000	Lire	3,438,723,000	2,604,363,000	3 - 5	97,177,000
Japan	1911-12	283,314,000	283,314,000	1911	Yen	2,650,395,000			1,319,897,000	4 - 5	73,533,000
Formosa	1911-12	21,739,000	21,739,000								
Korea	1911-12	24,273,000	24,273,000	1911	Yen	29,255,000			14,569,000	6 - 6½	863,000
Liberia	1910	[56] 370,000	[56] 370,000	1910	U. S. dollars	1,051,000	U. S. dollars	239,000	1,290,000	6 - 7	
Luxemburg	1910	[56] 3,532,000	[56] 3,679,000	1910	Francs	10,835,000			2,091,000	3½	204,000
Mexico	1910	[56] 52,952,000	[56] 47,324,000	1910	Pesos	438,375,000	Pesos	273,000	218,447,000	3 - 5	13,073,000
Netherlands	1911	78,083,000	85,930,000	1911	Florins	1,116,870,000			448,982,000	2½- 3	14,921,000
Dutch East Indies	1910	78,954,000	86,636,000								
Dutch Possessions in America	1911	2,881,000	3,342,000								
Norway	1910	[56] 32,761,000	[56] 31,289,000	1910	Kroner	329,298,000			88,252,000	3 - 3½	4,144,000
Paraguay	1910	2,154,000	2,567,000	1911	Pesos gold	4,589,000	Pesos gold	649,000	5,821,000	3 - 7	835,000
							Pesos paper	11,787,000			
Peru	1910	[56] 13,606,000	[56] 13,068,000	1911	£	3,843,000	£	1,552,000	26,253,000	1 - 5½	542,000
Portugal	1909-10	[56] 78,144,000	[56] 81,131,000	1911	Milreis	727,713,000	Milreis	82,531,000	875,064,000	3 - 5	35,248,000
Portuguese Colonies	1910-11	[57] 12,345,000	[57] 12,600,000								
Roumania	1910-11	88,988,000	88,988,000	1910	Francs	1,553,153,000			299,758,000	3½- 7½	17,121,000
Russia	1912	[57]1,532,255,000	[57]1,532,255,000	1911	Rubles	9,030,305,000			4,650,607,000	3 - 6	208,345,000
Finland	1909	[56] 35,698,000	[56] 34,179,000	1910	Francs	179,704,000			34,683,000	3 - 4½	1,595,000
Santo Domingo	1910	[56] 4,706,000	[56] 4,645,000	1910	Dollars	13,459,000			13,459,000	5	1,200,000
Servia	1911	[57] 23,186,000	[57] 23,176,000	1911	Francs	679,455,000			131,135,000	4 - 5	6,503,000
Siam	1910-11	[57] 23,598,000	[57] 27,059,000	1911	£	2,083,000			10,135,000	4½	456,000
Spain	1910	[56] 226,242,000	[56] 217,745,030	1911	Pesetas	9,902,870,000			1,911,254,000	3 - 5	78,818,000
Sweden	1911	61,080,000	61,080,000	1910	Kronor	526,430,000			141,083,000	3 - 4	5,119,000
Switzerland	1910	[56] 29,747,000	[56] 30,774,000	1910	Francs	117,600,000	Francs	6,830,000	24,015,000	3 - 4	1,215,000
Turkey	1911-12	125,301,000	159,426,000	1911	£, Turkish	129,691,000			570,640,000	3½- 4	79,784,000
United Kingdom	1910-11	[56] 992,039,000	[56] 837,017,000	1911	£	692,573,000	£	40,500,000	3,567,498,000	2½- 2¾	110,492,000
British Colonies, n. e. s.	1909-10	[56] 154,294,000	[56] 162,182,000	1909	£	142,180,000	£	5,868,000	720,477,000	2½- 6	24,398,000
United States	1910-11	[56] 997,587,000	[56] 964,086,000	1911	Dollars	915,353,000	Dollars	100,431,000	1,015,784,000	2 - 4	21,311,000
Philippine Islands	1910-11	[56] 12,723,000	[56] 13,689,000	1911	Dollars	16,125,000			16,125,000	4	892,000
Uruguay	1910-11	[57] 24,145,000	[57] 24,127,000	1911	Pesos	134,229,000			138,793,000	3½- 5	8,527,000
Venezuela	1911-12	[57] 9,868,000	[57] 9,850,000	1910	Bolivares	198,252,000	Bolivares	2,495,000	38,744,000		1,924,000
Total		11,245,399,000	11,143,409,000						41,446,175,000		[58]1,698,125,000

COMMERCIAL AND FINANCIAL STATISTICS OF THE PRINCIPAL COUNTRIES OF THE WORLD—Continued.

Country.	Per capita.						Railroads.		Telegraph.		Post offices per 10,000 inhabitants.
	Imports.	Exports.	Revenue.	Expenditure.	Debt.	Interest.	Per 10,000 inhabitants.	Per 1,000 square miles.	Length of line per 10,000 inhabitants.	Length of wire per 10,000 inhabitants.	
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Number.*
Argentina	48.57	51.45	19.59	19.66	91.50	4.38	24.9	15.3	54.2	143.6	4.2
Australasia:											
Commonwealth of Australia	65.56	78.47	8.19	8.19			39.1	5.9	94.9	200.8	17.3
New Zealand	82.32	107.08	54.71	54.10	363.05	11.58	27.2	26.2	108.1	345.1	21.9
Austria-Hungary	11.29	9.57	1.77	1.71	20.66	.83	5.4	105.6			
Austria			18.78	18.78	46.23	1.79			9.9	48.6	3.3
Hungary			16.29	16.29	55.64	2.83			7.5	42.6	2.9
Belgium	109.50	87.49	16.91	16.90	95.70	3.77	7.0	465.0	6.1	32.4	2.1
Kongo, Belgian	.36	.62	.41	.60	2.18		.3	.6			.03
Bolivia	10.97	17.01	2.32	2.38	5.04	.33	2.8	1.1	13.7	18.3	.9
Brazil	11.16	14.68	8.24	9.11	38.60	1.36	6.3	4.0	17.1	34.6	1.5
Bulgaria	7.91	5.75	7.68	7.67	25.02	1.73	2.7	31.6	8.5	18.3	4.8
Canada	65.23	38.73	14.33	11.21	66.46	2.10	34.9	6.6	51.6	215.7	18.2
Central American States:											
Costa Rica	21.45	22.75	14.04	14.04	34.23	1.65	11.2	22.8		38.7	5.2
Guatemala	2.63	5.04	1.55	1.38	9.24	.86	2.3	10.3	21.0		1.4
Honduras	5.46	4.65	2.75	2.93	204.59	.40	1.9	2.4		58.2	4.8
Nicaragua	5.83	6.00	2.53	2.01	16.24	.66	2.9	3.5		60.6	2.3
Panama	25.95	4.57	8.71	8.89	.32	.02	5.2	6.0			2.5
Salvador	2.19	4.28	3.11	3.09	7.70	.77	6.0	11.9		14.6	.6
Chile	31.02	34.29	18.30	21.13	47.10	1.93	10.2	12.2		70.5	3.0
China	.93	.74	.58	.68	1.90	.10	.2	1.3	.8	1.3	.2
Colombia	3.54	3.67	2.04	2.37	5.26	.30	1.3	1.4	22.2		1.0
Cuba	50.02	59.54	19.28	18.80	28.76	2.01	9.8	46.3	23.5	28.6	2.3
Denmark	61.27	53.93	13.06	12.86	29.14	.93	7.7	137.3	8.2	28.8	5.6
Ecuador	4.68	8.70	5.31	5.05	14.12	.83	2.3	3.0	17.4		.5
Egypt	10.31	12.68	6.81	6.57	40.95	1.56	3.2	9.5	7.0	19.7	1.5
Sudan	3.60	1.82									
France	35.96	30.38	21.38	21.38	158.60	4.70	7.7	148.2	28.1	105.1	3.4
Algeria	19.05	19.08	5.33	5.33	1.96	.63	3.9	6.0	17.9	46.6	1.2
Tunis	9.13	10.42	5.71	5.71	20.28	1.01	4.3	14.7	12.9	44.6	1.8
French Indo-China	2.84	2.74	1.40	1.40	3.87	.14	.6	4.3	5.2	8.9	.2
French Colonies, n. e. s.	1.98	1.97	1.13	1.12	2.92	.09	.7	.5	6.4	8.5	.2

German Empire			10.72	10.72	18.86	1.05	5.9	182.0	21.5	64.7	7.8
German Customs Union	31.62	27.29									
German States			20.73	20.53	56.54	2.40					
German Colonies	2.35	1.40	1.57	2.00	1.44	.05	1.3	1.8	3.6	4.3	.1
Greece	10.09	7.46	10.38	10.26	62.00	2.27	3.7	39.3	19.1	36.7	4.1
Haiti	3.01	5.42	2.66	2.45	24.05	1.26	.3	5.8	.6		.4
India, British	1.33	2.11	1.24	1.19	4.11	.16	1.0	18.3	2.3	9.1	.6
Italy	17.31	10.39	13.82	13.53	75.08	2.80	3.1	96.6	10.0	52.6	3.0
Eritrea (Massoua)	5.08	2.16									
Japan (including Pescadores but excluding Formosa and Sakhalin)	4.56	4.47	5.58	5.53	26.00	1.45	1.0	34.7	4.6	20.1	1.4
Formosa	7.18	8.80	6.41	6.41			.8	20.1	1.8	5.5	.3
Korea	1.53	.77	1.88	1.88	1.13		.5	8.0	2.6	5.4	.3
Liberia	.64	.59	.24	.24	.86						
Luxemburg			13.58	14.15	8.04	.78	12.2	318.0	16.8	49.3	4.7
Mexico	6.81	9.71	3.52	3.14	14.50	.87	10.2	20.0	14.9	30.6	1.9
Morocco	2.37	1.44									
Netherlands	213.28	168.04	12.48	14.67	76.64	2.55	3.4	155.8	8.0	39.1	2.5
Dutch East Indies	2.75	4.57	2.08	2.28			.4	2.1	2.4	3.5	.4
Dutch Possessions in America	29.13	20.72	20.00	23.21			7.2	2.1			1.2
Norway	45.03	31.65	13.69	13.08	36.88	1.73	8.0	15.4	27.1	53.6	13.8
Paraguay	7.81	5.98	2.69	3.21	7.28	1.04	2.9	2.4	25.0		4.8
Persia	5.25	4.07					.04	.05	7.0	10.2	.2
Peru	4.58	6.93	2.98	2.87	5.76	.13	3.6	2.4	15.5		1.5
Portugal (including Madeira and Azores)	12.90	6.15	14.41	14.96	161.36	6.50	3.3	50.9	10.8	24.5	7.1
Portuguese Colonies	3.71	3.32	1.44	1.47			1.1	1.2	0.8	6.9	.9
Roumania	10.20	12.88	12.77	12.77	43.03	2.46	3.2	44.1	6.8	17.2	4.3
Russia	2.90	4.58	9.53	9.53	28.93	1.29	2.9	5.5	7.5	26.6	.9
Finland	23.12	16.05	11.67	11.17	11.33	.52	7.4	15.8			6.7
Santo Domingo	9.51	16.10	6.98	6.89	19.97	1.78	2.2	8.0	15.3		1.2
Servia	5.53	6.50	7.93	7.93	44.88	2.23	1.7	26.5	7.5	22.0	5.2
Siam	3.63	5.79	3.37	3.87	1.45	.07	1.0	3.5	6.5	9.4	.3
Spain	9.23	8.96	11.60	11.16	98.00	4.04	4.8	47.8	11.8	27.0	2.7
Sweden	29.94	22.96	11.06	11.06	25.55	.93	15.6	49.7	11.6	36.3	7.3
Switzerland	89.73	61.50	7.93	8.20	6.40	.32	7.8	183.1	6.1	43.1	11.2
Turkey	5.42	3.18	5.04	6.41	22.95	3.21	.4	.8	11.4	19.2	.4
Crete	11.45	9.69							6.7		.3
Union of South Africa	27.74	44.29					12.7	16.0	32.8	98.3	4.0
United Kingdom	72.76	46.17	21.87	18.45	78.64	2.63	5.2	192.7	12.9	257.9	5.3
British Colonies, n. e. s.	10.34	9.63			18.37	.62	1.4	2.4	7.2		.6
United States	16.39	21.56	10.68	10.32	10.88	.23	25.8	66.4	23.5	159.2	6.3
Philippine Islands	6.02	4.81	1.54	1.65	1.96	.11	.7	5.3	5.2	8.0	.7
Porto Rico							3.0	99.6	5.3	12.5	
Uruguay	38.49	38.97	21.71	21.70	124.81	7.67	13.2	20.4		43.6	9.2
Venezuela	5.76	6.96	3.67	3.67	14.42	.72	2.0	1.5		18.3	1.0

[1] Figures of commerce include bullion and specie.
[2] Territory of Papua not included. Commerce exclusive of intercolonial trade.
[3] Figures of commerce include total imports and exports of domestic products.
[4] Figures of commerce include merchandise only.
[5] Figures of commerce include imports for consumption and domestic exports.
[6] Not included in grand totals of area and population.
[7] From United States returns. Exports from the United States into, and imports into the United States from the respective countries.
[8] Specie not included in figures of commerce.
[9] Commerce includes bullion and foreign coins.
[10] Year ending Mar. 31.
[11] Commerce of Canal Zone not included.
[12] Figures of commerce include general trade.
[13] Figures of commerce include gold and silver bullion, but not coin.
[14] Inclusive of Kiauchau, the figures for which are included also in the Chinese trade.
[15] Fiscal year ending Sept. 30.
[16] Government stores included in imports, but not in exports. Area and population include feudatory States.
[17] Figures of commerce include trade with Japan.
[18] Imports through post offices not included in figures of commerce.
[19] Year ending June 30.
[20] Figures of commerce include imports and exports for the Government. Trade with the United States is not stated separately, but is included in "Total America." Exports to "Total America" include $864,000 "for orders."
[21] Year ending Mar. 20.
[22] Include transit trade figures for Macao. Figures of trade with the United States (see note 7) are for the calendar year 1908.
[23] Figures of commerce include trade of Bangkok only.
[24] Figures of commerce do not include imports of war materials, supplies for foreign embassies and consulates, and for religious and educational institutions, agricultural machinery, and material for certain railway companies, harbor works, and factories. The trade with the United States is not stated separately, but is included with "Total America."
[25] Year ending Mar. 13.
[26] Figures of commerce include bullion and specie and articles for Governments.
[27] Trade does not include Government supplies nor free entries for railways. The latter amount to $315,000.
[28] Figures of commerce are those of special trade, including bullion, but not coin.
[29] Postal figures are for calendar year 1909, unless otherwise stated.
[30] Includes "chemins de fer vicinaux."
[31] Figures are for the fiscal year ending June 30, 1908.
[32] Includes cable lines.
[33] Figures are for the fiscal year ending Mar. 31, 1910.
[34] Postal figures for Central America, Salvador excepted, are for 1910.
[35] Calendar year 1910.
[36] Figures for 1907.
[37] Includes length of line in the Sudan.
[38] Included with domestic money orders.
[39] Postal data for year ending Mar. 31, 1909.
[40] Includes 47 miles in Eritrea.
[41] Includes 1,074 miles in Eritrea.
[42] Including 434 miles of line and 615 miles of wire in Japanese Sakhalin.
[43] Included with Japan.
[44] Postal data for year ending June 30, 1910.
[45] Exclusive of 1,632 miles of local railways.
[46] Includes police, railway, and private lines.
[47] Included with Russia.
[48] Postal data for year ending Feb. 29, 1908.
[49] Postal data for year ending Aug. 31, 1909.
[50] Data for Cape Colony, Natal, and Orange Free State only.
[51] Includes telephones.
[52] Including railway mileage in Alaska (390 miles) and Hawaii (175 miles), but exclusive of mileage of switching and terminal companies.
[53] Data for Western Union Telegraph Co. only.
[54] Postal data for the United States are for the fiscal year 1911; data for Porto Rico included.
[55] Budget law unless otherwise stated.
[56] Actual revenue and expenditure.
[57] Estimates submitted to the legislature.
[58] Incomplete data.

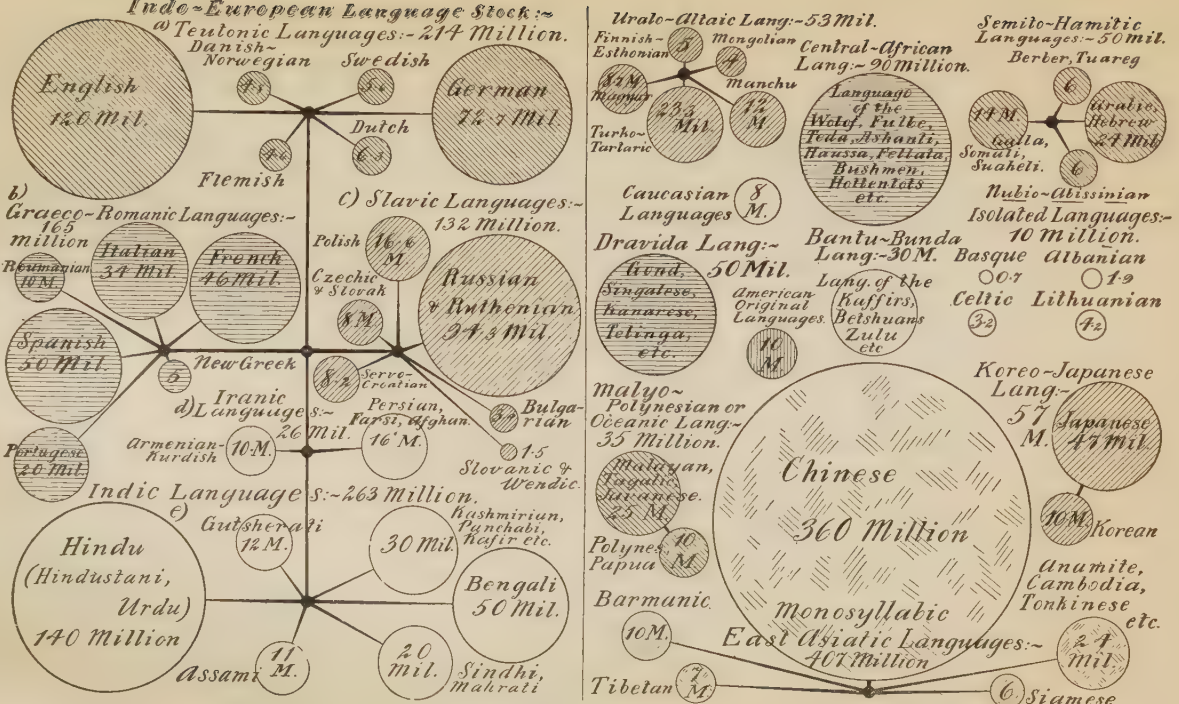
EXPORTS AND IMPORTS.

IMPORTS AND EXPORTS BY GRAND DIVISIONS AND COUNTRIES.

The exports of the United States for the first time crossed the two billion dollar line at the end of the fiscal year 1911, the total value of domestic merchandise exported being $2,013,000,000, while the foreign merchandise exported also showed a larger total than ever before, $35,771,000, making the grand total of exports $2,049,000,000. Imports amounted to $1,527,000,000 in the fiscal year 1911, against $1,527,000,000 in the immediately preceding year, making the total foreign commerce $3,576,000,000. The excess of exports over imports was $522,000,000, against $188,000,000 in 1910 and $351,000,000 in 1909.

Imports from Europe were valued at 819½ million in the fiscal year 1912, against 768 million in the preceding fiscal year; from North America, 334 million dollars in 1912, against 305½ million in 1911; from South America, 215 million dollars, against 182½ million in the preceding year; from Asia, 225½ million against 213½ million in the earlier year; from Oceania, 36½ million, against 30 million in 1911; and from Africa, 22½ million in the fiscal year 1912, against 27 million in the preceding year.

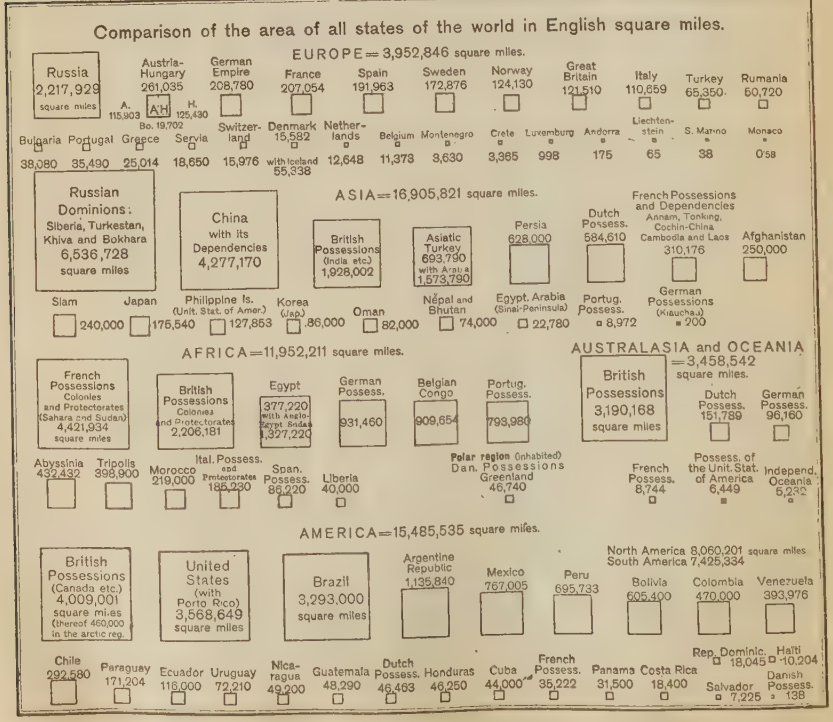
Turning to exports, the figures of the value of merchandise sent out of the United States show larger totals in exports to practically all the important countries of the world and to all of the grand divisions. To Europe the total for the fiscal year 1912 was 1,341¾ million dollars, against 1,308 in 1911; to North America, 516¾ million dollars in 1912, against 457 million in the preceding year; to South America, 132 million, against 109 million in 1911; to Asia, 117½ million, against 85 million in the preceding year; to Oceania, 72 million, against 66 million in 1911; to Africa, 24 million in 1912, against 23½ million in the prior year.



LANGUAGES OF THE WORLD.

FOREIGN CARRYING TRADE OF THE UNITED STATES, 1821–1911.

Year.	Total imports and exports. In cars and other land vehicles.	By sea. In American vessels.	By sea. In foreign vessels.	By sea. Total.	Per cent. carried in American vessels.
1821	.....	$113,201,462	$14,358,235	$127,559,697	88.7
1830	.....	129,918,458	14,447,970	144,366,428	89.9
1840	.....	198,424,609	40,802,856	239,227,465	82.9
1850	.....	239,272,084	90,764,954	330,037,038	72.5
1860	.....	507,247,757	255,040,793	762,288,550	66.5
1870	.....	352,969,401	638,927,488	991,896,889	35.6
1880	$20,981,393	258,346,577	1,224,265,434	1,482,612,011	17.4
1890	73,571,263	202,451,086	1,371,116,744	1,573,567,830	12.9
1900	154,895,650	195,084,192	1,894,444,424	2,089,528,616	9.3
1910	319,132,528	260,837,147	2,721,962,475	2,982,799,622	8.7
1911	365,903,334	280,206,464	2,930,436,506	3,210,642,970	8.7



Trade With the Non-Contiguous Territories of the United States.

The trade of the United States with its non-contiguous territories continued to expand, the figures of 1911 showing a larger amount than ever before. The value of the merchandise forwarded to the non-contiguous territories was: To Hawaii, 22 million dollars, against 20½ million in the preceding year; to Porto Rico, 34½ million in 1911, against 27 million in 1910; to the Philippines, 20 million, against 17 million in 1910; while to Alaska the figures show a slight decline, being 16 million in the fiscal year 1911, against 18½ million in the preceding year. This makes the total value of the merchandise shipped to non-contiguous territories of the United States 92½ million dollars in 1911, against 83 million in 1910, and 70 million in 1909. The merchandise entering the United States from its non-contiguous territories shows in the most cases larger totals in 1911 than in the preceding year. From Alaska the value of such shipments was 14 million dollars in 1911, against 12½ million in the preceding year; from Porto Rico, 34½ million, against 32 million in 1910; from the Philippines, 17½ million in 1911, against 17⅓ million in the preceding year; and from Hawaii, 41 million, against 46 million in 1910. Taking the entire group known as "Non-contiguous territories of the United States," the total value of merchandise shipped thereto from the United States was 92½ million dollars in the fiscal year 1911, against 83 million in 1910, and 70 million in 1909, and the shipments to the United States from those territories, 107½ million in 1911, against 108 million in 1910 and 89½ million in 1909.

Merchandise Imported: Value and Per Cent. of Total Value, in Specified Years, 1821 to 1911 by Great Groups.

Year ended June 30.	Foodstuffs in crude condition, and food animals.		Foodstuffs partly or wholly manufactured.		Crude materials for use in manufacturing.		Manufactures for further use in manufacturing		Manufactures ready for consumption.		Miscellaneous.		Total value.
	Value.	Per ct.	Value.	Per ct.	Value.	Per ct.	Value.	Per ct.	Value.	Per ct.	Value.	Per ct.	
	Dollars.		*Dollars.*		*Dollars.*		*Dollars.*		*Dollars.*		*Dollars.*		*Dollars.*
1821	6,081,641	11.15	10,820,814	19.85	1,983,706	3.64	4,079,064	7.48	30,998,900	56.86	556,709	1.02	54,520,834
1830	7,892,274	11.77	9,653,971	15.39	4,214,825	6.72	5,152,486	8.22	35,734,837	56.97	582,563	.93	62,720,956
1840	15,273,321	15.54	15,188,845	15.46	11,510,245	11.71	11,356,196	11.56	44,300,005	45.09	630,094	.64	98,258,706
1850	18,911,699	10.38	21,465,776	12.37	11,711,266	6.75	26,163,152	15.08	93,312,499	54.93	845,174	.49	173,509,526
1860	35,743,828	10.11	53,771,067	15.26	37,073,022	10.48	23,613,395	6.67	199,878,690	56.52	3,536,119	1.00	353,616,119
1870	53,981,838	12.38	96,253,561	22.08	53,118,022	12.18	54,545,306	12.51	173,034,847	39.69	5,024,834	1.16	435,958,408
1880	100,297,040	15.01	118,125,216	17.69	131,861,617	19.74	110,779,516	16.59	196,587,405	29.43	10,303,952	1.54	667,954,746
1890	128,480,142	16.28	133,339,031	16.89	170,637,250	21.62	116,924,080	14.81	230,685,551	29.23	9,251,325	1.17	789,310,409
1900	97,916,293	11.52	133,027,374	15.65	276,241,152	32.50	134,222,045	15.79	203,126,341	23.90	5,407,979	.64	849,941,184
1910	144,776,636	9.30	181,566,572	11.66	566,270,770	36.37	285,138,373	18.31	367,723,367	23.62	11,471,712	.74	1,556,947,430
1911	181,194,863	11.87	172,006,501	11.26	511,362,140	33.48	289,785,652	18.84	361,422,180	23.67	13,464,769	.88	1,527,226,105

IMPORTS INTO THE UNITED STATES OF PRINCIPAL CRUDE ARTICLES FOR USE IN MANUFACTURING FOR SPECIFIED YEARS, 1870–1911.

[These ten groups embrace about three-fourths of the value of crude materials imported for use in manufacturing.]

YEARS ENDING JUNE 30—	Fibers, unmanufactured.	Silk, raw.	India rubber, gutta-percha, and substitutes for.	Hides and skins.	Furs and fur skins, undressed.	Chemicals, drugs, and dyes.	Wool, raw.	Cotton, raw.	Wood, unmanufactured.	Tin in bars blocks, etc.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
1870	6,043,102	3,017,958	3,459,665	14,402,339	2,236,229	11,265,451	6,743,350	331,573	670,131	1,984,238
1875	6,236,099	4,504,306	4,675,490	18,536,902	4,530,753	11,726,955	11,071,259	408,808	1,895,585	2,327,212
1880	9,392,808	13,837,899	9,666,239	30,002,254	2,496,277	17,859,662	23,727,650	591,120	2,884,579	6,223,176
1885	12,362,498	12,925,437	9,095,256	20,586,443	1,854,282	12,057,527	8,879,923	954,760	3,587,651	4,283,460
1890	20,541,767	24,331,867	14,854,512	21,881,886	2,165,213	15,434,869	15,264,083	1,392,728	4,254,789	6,898,909
1891	21,286,705	19,076,081	18,020,804	27,930,759	2,822,166	18,605,987	18,231,372	2,825,004	5,288,264	7,977,545
1892	19,124,094	25,059,325	19,833,090	26,850,218	3,352,429	17,211,612	19,688,108	3,217,521	5,626,143	8,667,870
1893	21,371,555	29,836,986	17,964,667	28,347,896	4,049,173	19,538,444	21,064,180	4,688,799	6,705,798	12,358,999
1894	12,163,481	16,234,182	15,162,333	16,786,152	2,641,205	14,534,859	6,107,438	3,003,888	6,010,492	2,640,770
1895	13,282,081	22,626,050	18,475,382	26,122,942	3,320,058	15,364,997	25,556,421	4,714,375	7,374,205	6,787,424
1896	12,870,694	26,763,428	16,781,533	30,520,177	3,545,700	17,794,259	32,451,242	6,578,212	8,439,156	6,761,716
1897	12,336,418	18,918,283	17,558,183	27,863,026	2,938,979	16,314,041	53,243,191	5,884,262	8,519,928	6,535,852
1898	13,446,186	32,110,066	25,545,391	37,068,932	3,832,603	16,166,245	16,783,692	5,019,503	6,434,091	8,776,151
1899	20,300,093	32,479,627	32,041,626	41,988,043	5,645,731	17,294,784	8,322,897	5,013,146	5,849,912	11,843,357
1900	26,373,805	45,329,760	31,792,697	57,935,698	6,646,807	20,452,489	20,260,936	7,960,945	5,961,456	19,104,301
1901	22,932,506	30,051,365	28,835,178	48,220,013	6,233,842	20,256,257	12,529,881	6,787,828	6,950,123	19,805,551
1902	31,545,962	42,635,351	25,652,977	58,011,168	9,787,013	22,216,861	17,711,788	12,208,231	7,587,601	19,461,850
1903	34,462,513	50,011,050	31,004,541	58,031,613	8,815,108	25,496,483	22,152,961	11,698,653	8,204,963	23,618,802
1904	37,814,285	46,100,500	41,049,434	52,006,070	9,005,873	25,688,083	24,813,591	9,387,331	8,429,218	21,486,311
1905	38,118,071	61,040,053	50,729,873	64,764,146	10,502,907	23,877,238	46,225,558	10,656,624	7,880,746	23,378,471
1906	39,360,290	54,080,504	46,188,374	83,882,167	13,116,716	28,882,157	39,068,372	12,235,634	8,931,114	30,932,998
1907	42,239,358	71,411,899	60,511,459	83,206,545	12,911,434	29,108,453	41,534,028	20,973,255	11,471,595	38,117,459
1908	35,493,083	64,546,903	38,030,022	54,770,136	9,580,323	24,306,604	23,664,938	14,017,734	12,500,487	25,295,061
1909	29,748,353	79,903,586	63,167,103	78,487,324	11,653,586	23,833,946	45,171,994	13,622,802	11,455,143	26,007,216
1910	32,418,839	67,129,603	103,862,799	112,247,836	15,589,258	24,609,326	51,220,844	15,816,138	15,176,506	30,869,532
1911	30,752,250	74,998,265	90,575,643	70,504,980	15,351,001	23,122,846	23,228,005	24,776,320	14,475,198	37,935,978

COMPARISON OF SPEED.

	In one sec.
Snail	1½ in.
Pedestrian	3 ft.
Horse walking	4 "
Pedestrian walking quickly	6⅔ "
Horse trotting	11½ "
Gentle breeze	13 "
Horse galloping	15 "
River-steamer	16 "
Sailing boat	9 yds.

	In one sec.
Ocean-steamer	11 yds.
Skater	13 "
Luggage train	13 "
Storm	19 "
Parliamentary train	20 "
Carrier pigeon	20 "
Velocipede (racing)	22 "
Horse (racing)	27 "
Express train	28 "

	In one sec.
Swallow	50 yds.
Sound	360 "
Breech loading rifle	470 "
Cannon ball	490 "
Revolution of the earth on its axis at the equator	490 "
Revolution of the earth around the sun	19 mi.
Light	186,000 "
Electricity	250,000 "

VIEW OF THE WHOLE ANTARCTIC CONTINENT, SHOWING THE METHOD OF APPROACH OF THE VARIOUS EXPEDITIONS.

Courtesy of "The Sphere."

IMPORTS AND EXPORTS OF MERCHANDISE BY PRINCIPAL ARTICLES YEAR ENDING JUNE 30, 1911.

EXPORTS.

Order of magnitude, 1911.	ARTICLES.	1911	
		Value.	Per cent of total.
		Dollars.	
1	Cotton, unmanufactured	585,318,869	29.07
2	Iron and steel, and manufactures of	230,725,352	11.46
3	Meat and dairy products	149,389,737	7.42
4	Breadstuffs	124,913,537	6.20
5	Copper, and manufactures of	104,908,406	5.21
6	Mineral oils	98,115,516	4.87
7	Wood, and manufactures of	92,255,951	4.58
8	Leather, and manufactures of	53,673,056	2.67
9	Coal	45,013,436	2.24
10	Tobacco, and manufactures of	43,638,904	2.17
11	Cotton, manufactures of	40,851,918	2.03
12	Agricultural implements	35,973,398	1.79
13	Cars, carriages, etc	30,534,936	1.52
14	Naval stores	25,022,720	1.24
15	Fruits and nuts	24,498,465	1.22
16	Chemicals, drugs, dyes, and medicines	23,007,414	1.14
17	Vegetable oil	19,805,232	.98
18	Oil cake and oil-cake meal	19,631,127	.97
19	Paper, and manufactures of	19,215,499	.95
20	Animals	19,048,653	.94
21	India rubber, and manufactures of	12,452,562	.62
22	Instruments for scientific purposes	12,421,512	.62
23	Fertilizers	10,721,132	.53
24	Furs and fur skins	10,473,517	.52
25	Fibers, vegetable, etc., manufactures of	8,565,990	.43
26	Fish	7,698,321	.38
27	Paraffin and paraffin wax	7,378,736	.37
28	Photographic goods	7,142,603	.36
29	Household and personal effects	7,094,366	.35
30	Paints, pigments, and colors	6,294,746	.31
31	Brass, and manufactures of	6,230,092	.31
32	Nickel, nickel oxide, and matte	6,004,414	.30
33	Vegetables	5,545,091	.28
34	Sugar, molasses, and confectionery	5,340,730	.26
35	Grease, grease scraps, etc	5,177,581	.26
36	Coffee, green	5,107,949	.25
37	Explosives	4,763,242	.24
38	Soap	4,046,981	.20
39	Coke	3,300,964	.16
40	Seeds	2,475,066	.12
	All other articles	89,771,304	4.46
	Total	2,013,549,025	100.00

IMPORTS.

Order of magnitude, 1911.	ARTICLES.	1911	
		Value.	Per cent of total.
		Dollars.	
1	Sugar	98,691,096	6.33
2	Chemicals, drugs, and dyes	95,101,006	6.23
3	India rubber and gutta-percha, crude	90,575,643	5.93
4	Coffee	90,567,788	5.93
5	Silk, unmanufactured	74,998,193	4.91
6	Hides and skins, other than fur skins	70,504,980	4.62
7	Cotton, manufactures of	66,996,551	4.39
8	Fibers, vegetable, etc., manufactures of	54,765,999	3.59
9	Wood, and manufactures of	52,931,803	3.47
10	Fruits and nuts	41,515,067	2.72
11	Diamonds and other precious stones	40,725,400	2.67
12	Tin in bars, blocks, pigs, etc	37,935,978	2.48
13	Iron and steel, and manufactures of	35,984,363	2.36
14	Tobacco, and manufactures of	33,272,462	2.18
15	Oils	33,023,687	2.16
16	Silk, manufactures of	32,137,837	2.10
17	Copper, manufactures of	32,013,562	2.10
18	Fibers, vegetable, etc., unmanufactured	30,752,250	2.01
19	Seeds	29,757,955	1.95
20	Cotton, unmanufactured	24,776,320	1.62
21	Furs, and manufactures of	23,618,948	1.55
22	Wool, unmanufactured	23,228,005	1.52
23	Art works	22,495,842	1.47
24	Articles, the growth, etc., of the United States, returned	20,917,296	1.37
25	Paper, and manufactures of	18,626,880	1.22
26	Wool, manufactures of	18,569,791	1.22
27	Spirits, wines, and malt liquors	18,004,908	1.18
28	Tea	17,613,569	1.15
29	Fish	14,939,314	.98
30	Leather, and manufactures of	14,636,720	.96
31	Cocoa, or cacao, crude, and shells of	14,552,879	.95
32	Meat and dairy products	14,209,970	.93
33	Breadstuffs	13,452,732	.88
34	Earthen, stone, and china ware	11,411,665	.75
35	Fertilizers	10,150,142	.66
36	Vegetables	9,293,855	.61
37	Metals, metal compositions, and manufactures of, n. e. s.	9,007,015	.59
38	Copper ore, matte, and regulus	7,659,542	.50
39	Hats, bonnets, and hoods, and materials for	7,653,548	.50
40	Animals	6,850,964	.45
	All other articles	165,304,640	10.81
	Total	1,527,226,105	100.00

PRINCIPAL PORTS OF THE WORLD: FOREIGN COMMERCE DURING THE LATEST YEAR FOR WHICH DATA ARE AVAILABLE.

[Sources: Official reports of the respective countries.]

Country and port.	Year.[1]	Imports.	Exports.	Total commerce.
EUROPE.				
United Kingdom:		*Dollars.*	*Dollars.*	*Dollars.*
London[2]	1910	1,110,828,205	643,014,124	1,753,842,329
Liverpool	1910	828,620,152	829,250,836	1,657,870,988
Hull	1910	205,765,480	150,630,959	356,396,439
Manchester[3]	1910	145,726,880	85,111,683	230,838,563
Southampton	1910	103,588,830	119,420,173	223,009,003
Glasgow	1910	70,726,450	143,857,594	214,584,044
Harwich	1910	61,395,564	92,268,305	153,663,869
Grimsby	1910	102,940,379	33,727,254	136,667,633
Leith	1910	45,954,087	55,031,243	100,985,330
Tyne ports[4]	1910	65,988,061	33,921,982	99,910,043
Cardiff	1910	31,024,453	63,473,550	94,498,003
Bristol	1910	72,956,694	20,946,891	93,903,585
Belfast	1910	38,632,331	6,393,802	45,026,133
Germany:				
Hamburg	1910	372,629,975	661,480,352	1,534,110,327
Bremen	1910	289,388,012	224,819,348	514,187,360
Belgium: Antwerp	1910	560,994,911	523,075,033	1,084,069,944
France:				
Marseille	1910	340,787,600	297,626,300	638,413,900
Havre	1910	306,958,600	255,014,600	561,973,200
Dunkirk	1910	170,513,600	34,586,600	205,100,200
Bordeaux	1910	100,160,200	110,245,700	210,405,900
Italy: Genoa	1908	151,710,829	69,792,702	221,503,531
Austria-Hungary:				
Trieste	1910	122,153,658	128,050,033	250,203,691
Fiume	1909	24,623,494	24,108,483	48,731,977
Russia:				
St. Petersburg	1909	64,562,173	4,829,726	69,391,899
Riga	1909	32,646,436	82,888,874	115,535,310
Odessa	1909	35,097,293	23,747,639	58,844,932
Reval	1909	27,722,640	13,708,395	41,431,035
Vladivostok	1909	18,014,311	784,939	18,799,250
Batoum	1909	5,341,553	18,692,627	24,034,180
Spain:				
Barcelona	1909	54,034,028	26,313,747	80,347,775
Bilbao	1909	16,517,323	11,446,608	27,963,931
AMERICA.				
United States:[5]				
New York	1911	881,592,689	772,552,449	1,654,145,138
New Orleans	1911	66,722,295	172,835,293	239,557,588
Galveston	1911	3,530,945	220,504,917	224,035,862
Boston[6]	1911	116,597,440	71,534,082	188,131,522
Philadelphia	1911	83,626,647	69,956,380	153,583,027
Baltimore	1911	32,174,404	85,120,843	117,295,247
San Francisco	1911	53,885,021	40,624,903	94,509,924
Savannah	1911	5,296,746	72,076,045	77,372,791
Puget Sound	1911	36,654,675	39,361,303	76,015,978
Canada: Montreal[7]	1911	116,866,171	74,330,938	191,197,109
Mexico:[5]				
Tampico	1911	21,993,561	46,096,331	68,089,892
Vera Cruz	1911	38,383,232	26,724,073	65,107,305
Cuba: Habana	1910	71,793,680	46,946,485	118,740,165
Argentina: Buenos Aires	1910	271,053,026	156,225,552	427,278,578
Brazil:				
Santos	1910	46,048,404	92,941,797	138,990,201
Rio Janeiro	1910	87,257,063	38,068,876	125,325,939
Chile:				
Valparaiso	1909	45,109,846	4,984,218	50,094,064
Iquique	1909	8,345,005	22,098,422	30,443,427
Uruguay: Montevideo	1908	34,949,864	30,908,320	65,858,184

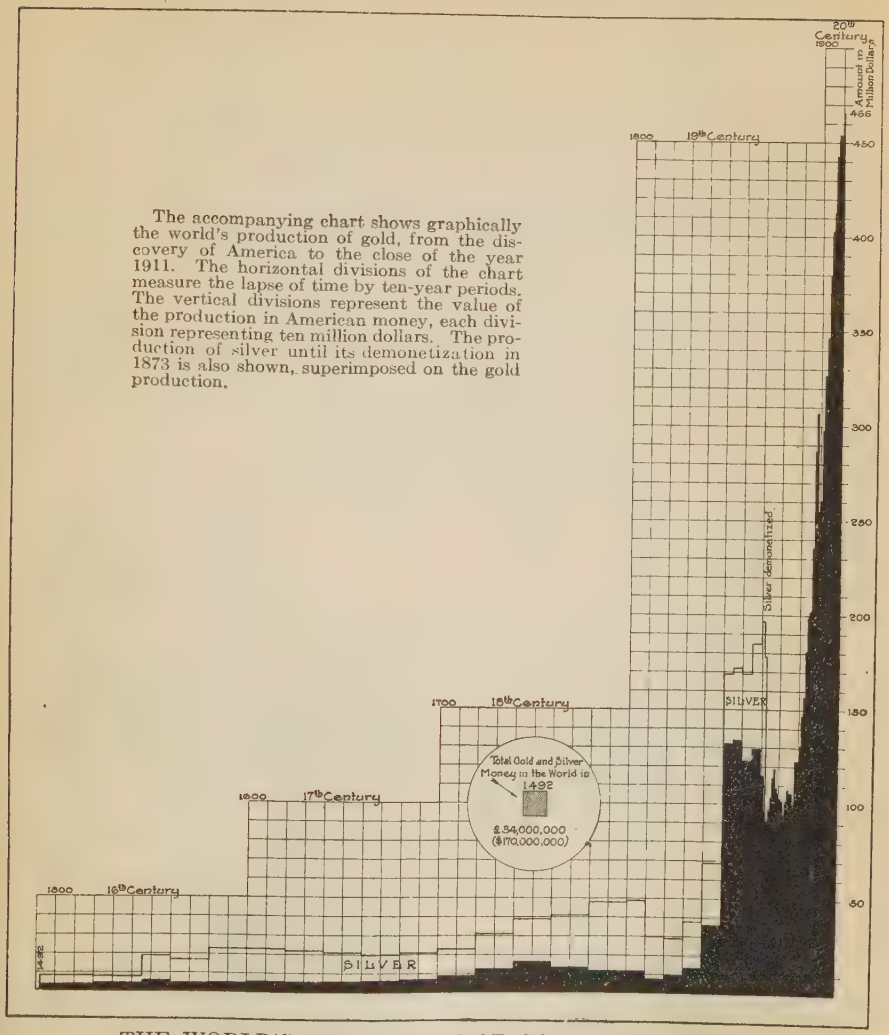
[1] Calendar years unless otherwise specified by note.
[2] Including Queenborough.
[3] Including Runcorn.
[4] Tyne ports comprise Newcastle, North Shields, and South Shields.
[5] Years ended June 30.
[6] Including Charlestown.
[7] Years ended Mar. 31.

PRINCIPAL PORTS OF THE WORLD: Vessel Tonnage Movement in the Foreign Trade, during the Latest Year for which Data are Available.

[Sources: Official reports of the respective countries.]

Country and port.	Year.[1]	Entered.	Cleared.
EUROPE.			
Great Britain:		*Tons.*	*Tons.*
Cardiff	1910	5,523,895	8,562,764
Hull	1910	3,749,882	3,477,484
Liverpool	1910	7,588,653	6,697,512
London	1910	12,154,162	8,999,635
Tyne ports	1910	5,022,250	6,128,928
Glasgow	1910	2,037,332	3,292,887
Malta-Valetta[2]	1911	4,337,736	4,329,301
Gibraltar	1910	5,482,559	5,457,659
Germany:			
Hamburg	1910	11,417,773	11,583,211
Bremen	1910	1,258,907	1,209,137
Bremerhaven	1910	1,585,334	1,572,758
Denmark: Copenhagen	1909	3,085,000	3,174,000
France:			
Havre	1909	3,947,402	4,070,467
Bordeaux	1909	1,955,276	2,084,861
Dunkirk	1909	2,027,483	2,026,795
Marseille	1909	7,775,411	7,977,386
Austria: Trieste	1910	2,733,133	2,661,836
Belgium: Antwerp	1910	12,654,318	12,625,165
Netherlands: Rotterdam	1910	10,649,843	10,490,049
Italy:			
Genoa	1909	4,908,474	4,092,148
Naples	1909	3,371,332	3,737,863
Russia:			
Cronstadt-St. Petersburg	1909	1,866,000	1,874,000
Odessa	1909	1,289,000	1,211,000
Riga	1909	1,558,000	1,597,000
Nikolaiev	1909	1,028,000	1,012,000
Vladivostok	1909	734,000	699,000
Spain:			
Barcelona	1909	2,502,033	1,661,858
Bilbao (Vizcaya)	1909	2,036,785	2,212,636
Turkey: Constantinople	1910	[3] 16,215,459	
AMERICA.			
United States:[4]			
New York	1911	13,428,950	13,366,893
Boston and Charlestown	1911	2,836,611	1,839,682
Philadelphia	1911	2,672,883	2,327,119
Baltimore	1911	1,279,487	1,283,822
Galveston	1911	830,272	1,049,787
New Orleans	1911	2,019,067	2,249,883
AMERICA—contd.			
United States—Continued.		*Tons.*	*Tons.*
Puget Sound	1911	2,105,599	2,272,562
San Francisco	1911	987,374	1,138,009
Canada:[2]			
Montreal	1911	1,661,370	1,609,337
Vancouver	1911	1,509,445	1,010,658
Victoria	1911	1,322,890	1,759,861
Mexico:[4,5]			
Vera Cruz	1910	1,673,845	1,768,540
Tampico	1910	1,259,846	1,258,034
Argentina: Buenos Aires	1908	5,981,477	5,079,863
Brazil:			
Santos	1909	2,983,879	2,990,307
Rio de Janeiro	1909	4,282,051	4,297,799
Cuba: Habana[4]	1910	2,870,799	2,816,195
ASIA.			
British India:			
Bombay[2]	1910	1,962,528	1,598,713
Calcutta[2]	1911	2,060,632	1,742,548
British Colonies:			
Hongkong-Victoria[6]	1910	10,489,203	10,477,301
Singapore[7]	1910	7,407,143	7,419,373
Colombo[8]	1910	6,937,361	6,919,960
Aden[2,9]	1910	3,187,479	3,200,168
China: Shanghai[10]	1910	9,198,490	9,459,584
Japan:			
Yokohama	1910	3,455,147	3,337,140
Nagasaki	1910	2,431,376	2,405,330
Kobe	1910	5,608,837	5,584,231
Moji	1910	4,131,787	4,151,244
AFRICA.			
Egypt: Alexandria	1910	3,319,515	3,344,640
Union of South Africa:			
Cape Town	1910	1,746,146	1,487,419
Port Natal	1910	3,244,089	3,217,146
OCEANIA.			
Australia:[11]			
Melbourne	1910	591,250	381,100
Sydney	1910	869,883	908,278
Fremantle	1910	775,324	614,328

[1] Calendar years unless otherwise specified by note.
[2] Year ended Mar. 31.
[3] Total movement of shipping, excluding sailing and small coasting vessels. Separate data for entrances and clearances not available. Year ended Feb. 28.
[4] Year ended June 30.
[5] Gross tons.
[6] Excluding Chinese junks engaged in the foreign trade.


The accompanying chart shows graphically the world's production of gold, from the discovery of America to the close of the year 1911. The horizontal divisions of the chart measure the lapse of time by ten-year periods. The vertical divisions represent the value of the production in American money, each division representing ten million dollars. The production of silver until its demonetization in 1873 is also shown, superimposed on the gold production.
20th Century
1900
Amount in Millions of Dollars
450
400
350
300
250
200
150
100
50
1800 19th Century
Silver demonetized
SILVER
1700 18th Century
Total Gold and Silver Money in the World in 1492
$54,000,000
($170,000,000)
1600 17th Century
1500 16th Century
1492
SILVER

THE WORLD'S PRODUCTION OF GOLD AND SILVER.

NOTES TO PRECEDING PAGE—Continued.

[7] Excluding warships, transports, yachts, native craft and steam and sailing vessels under 50 tons, but including vessels engaged in intersettlement trade.

[8] Excluding the tonnage of vessels that called for the purpose of coaling and for orders only.

[9] Including native craft. Figures for year ended Mar. 31, 1908.

[10] Tonnage of vessels entered and cleared at the maritime customs.

[11] Figures of direct entrances and clearances from and to places outside the commonwealth.

PRINCIPAL PORTS OF THE WORLD: FOREIGN COMMERCE DURING THE LATEST YEAR FOR WHICH DATA ARE AVAILABLE—Continued.

Country and port.	Year.[1]	Imports.	Exports.	Total commerce.
ASIA.		*Dollars.*	*Dollars.*	*Dollars.*
China: Shanghai [2]	1910	129,383,470	114,627,983	244,011,453
Japan:				
Yokohama	1910	76,833,707	112,136,886	188,970,593
Kobe	1910	114,822,654	60,813,155	175,635,809
British Colonies:				
Singapore [3]	1909	127,141,948	108,081,776	235,223,724
Calcutta [4 5]	1911	157,482,211	252,646,619	410,128,830
Bombay [4]	1910	128,231,068	180,221,358	308,452,426
AFRICA.				
Egypt: Alexandria	1910	101,224,909	140,189,861	241,414,770
OCEANIA.				
Australia: [6]				
Sydney	1909	98,007,553	119,803,283	217,810,836
Melbourne	1909	79,520,065	80,601,820	160,121,885

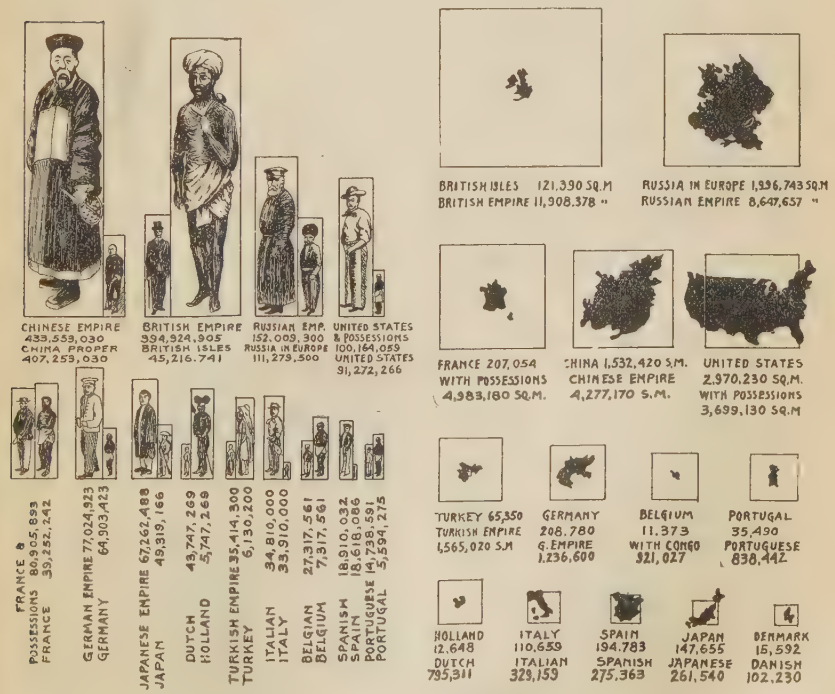
[1] Calendar years unless otherwise specified by note.
[2] Direct foreign trade, exclusive of reexports.
[3] Exclusive of intersettlement trade.
[4] Years ended Mar. 31.
[5] Merchandise only, exclusive of Government stores.
[6] Exclusive of interstate commerce.

ONE YEAR'S PRODUCTION.

GOLD: Values of Imports and Exports and Annual Excess of Imports or Exports, 1862 to 1911.[1]

Year ended June 30—	Exports.			Imports.	Excess of—	
	Domestic.[2]	Foreign.	Total.		Exports over imports.	Imports over exports.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
1862....	31,044,651	4,395,252	.....	13,907,011	.....	.....
1870....	28,580,609	5,055,353	33,635,962	12,056,950	21,579,012	.....
1880....	1,775,039	1,863,986	3,639,025	80,758,396	.....	77,119,371
1890....	13,403,632	3,870,859	17,274,491	12,943,342	4,331,149	.....
1900....	46,693,893	1,572,866	48,266,759	44,573,184	3,693,575	.....
1910....	114,569,714	3,993,501	118,563,215	43,339,905	75,223,310	.....
1911....	21,810,820	698,833	22,509,653	73,607,013	.....	51,097,360

[1]The figures relate to coin and bullion only prior to 1895; subsequently they include ore also.
[2]Gold and silver cannot be separately stated in domestic exports prior to 1864, but it is probable that the greater portion of the exports was gold, under which head the silver in question is included.

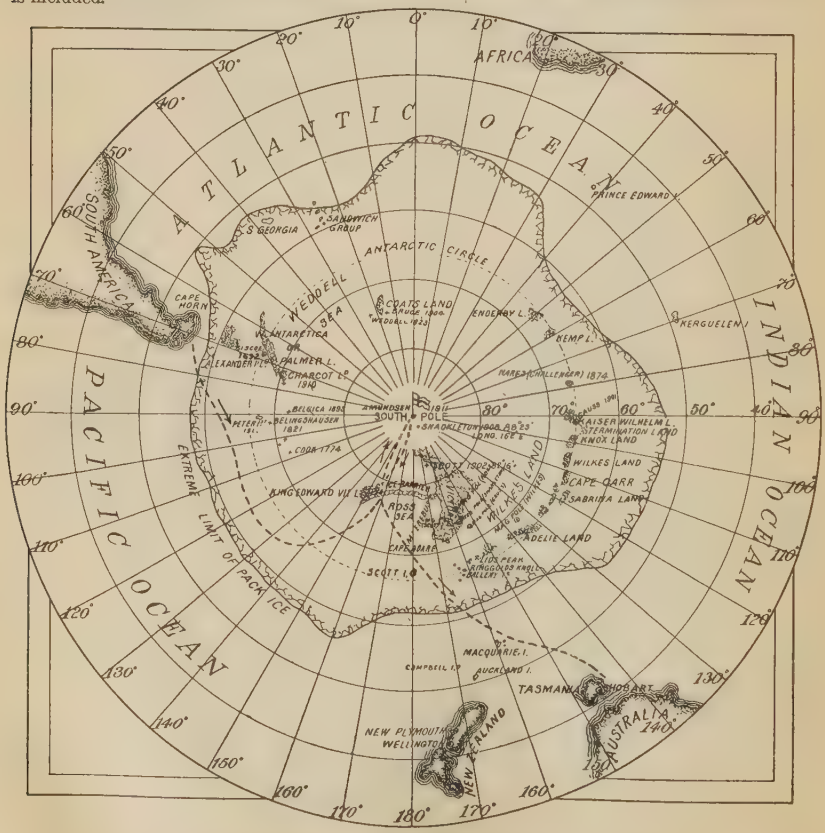


HOME AND COLONIAL POPULATIONS AND AREAS OF THE WORLD'S EMPIRES.

SILVER: VALUES OF IMPORTS AND EXPORTS AND ANNUAL EXCESS EXPORTS OVER IMPORTS, 1862 TO 1911.[1]

Year ended June 30—	Exports.			Imports.	Excess of exports over imports.
	Domestic.[2]	Foreign.	Total.		
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
1862	.....	1,447,737	.....	2,508,041	.....
1870	15,303,193	9,216,511	24,519,704	14,362,229	10,157,475
1880	7,572,854	5,931,040	13,503,894	12,257,914	1,227,980
1890	22,378,557	12,495,372	34,873,929	21,032,984	13,840,945
1900	52,464,345	4,247,930	56,712,275	35,256,302	21.455,973
1910	53,094,567	2,192,294	55,286,861	45,217,194	10,069,667
1911	60,068,925	4,681,033	64,749,958	45,937,249	18,812,709

[1]The figures relate to coin and bullion only prior to 1895; subsequently they include ore also.
[2]Gold and silver can not be separately stated in domestic exports prior to 1864, but it is probable that the greater portion of the exports was gold, under which head the silver in question is included.



THE PROGRESS OF ANTARCTIC EXPLORATION.

FAILURES IN THE UNITED STATES.

MANUFACTURERS.	Number		Liabilities	
	1911.	1910.	1911.	1910.
Iron, Foundries and Nails	61	80	$5,056,635	$11,748,872
Machinery and Tools	173	167	6,689,566	5,788,919
Woolens, Carpets and Knit Goods	53	31	4,329,758	1,277,813
Cottons, Lace and Hosiery	36	19	3,590,816	1,709,686
Lumber, Carpenters and Coopers	416	427	16,000,205	14,806,274
Clothing and Millinery	497	530	4,509,586	6,318,815
Hats, Gloves and Furs	68	53	978,002	763,756
Chemicals and Drugs	15	31	105,623	249,638
Paints and Oils	26	17	1,051,212	385,540
Printing and Engraving	172	187	2,448,366	5,729,994
Milling and Bakers	218	221	1,264,511	1,430,309
Leather, Shoes and Harness	79	71	1,577,919	2,319,839
Liquors and Tobacco	105	118	2,451,589	3,544,769
Glass, Earthenware and Bricks	127	116	3,972,382	5,025,462
All Other	1,455	1,212	33,345,453	27,817,199
Total Manufacturing	3,502	3,280	$87,371,623	$88,916,885
TRADERS.				
General Stores	1,380	1,228	$10,977,030	$8,719,230
Groceries, Meat and Fish	2,134	2,316	9,543,008	8,680,079
Hotels and Restaurants	486	468	3,762,792	5,523,322
Liquors and Tobacco	747	688	4,268,965	5,207,942
Clothing and Furnishings	1,036	965	10,015,849	8,388,015
Dry Goods and Carpets	671	592	11,320,606	9,756,558
Shoes, Rubbers and Trunks	349	358	2,461,699	2,227,357
Furniture and Crockery	287	226	2,877,533	2,402,980
Hardware, Stoves and Tools	302	244	3,401,792	3,030,710
Chemicals and Drugs	361	304	1,946,546	1,826,348
Paints and Oils	57	52	438,667	312,589
Jewelry and Clocks	296	242	3,270,182	3,271,427
Books and Papers	90	78	951,147	561,168
Hats, Furs and Gloves	62	46	886,204	823,363
All Other	1,222	1,122	18,117,659	14,259,905
Total Trading	9,480	8,929	$84,239,679	$74,990,993
Brokers and Transporters	459	443	19,450,363	37,849,219
Total Commercial	13,441	12,652	$191,061,665	$201,757,097
Banking	107	119	25,511,606	41,097,255

Year.	No.	Liabilities.	Year.	No.	Liabilities.	Year.	No.	Liabilities.
1870	3,546	$88,242,000	1884	10,968	226,343,427	1898	12,186	$130,662,899
1871	2,915	85,252,000	1885	10,637	124,220,321	1899	9,337	90,879,889
1872	4,069	121,056,000	1886	9,834	114,644,119	1900	10,774	138,495,673
1873	5,183	228,499,900	1887	9,634	167,560,944	1901	11,002	113,092,376
1874	5,830	155,239,000	1888	10,679	123,829,973	1902	11,615	117,476,769
1875	7,740	201,000,000	1889	10,882	148,784,337	1903	12,069	155,444,185
1876	9,092	191,117,000	1890	10,907	189,856,964	1904	12,199	144,202,311
1877	8,872	190,669,936	1891	12,273	189,868,638	1905	11,520	102,676,172
1878	10,478	234,383,132	1892	10,344	114,044,167	1906	10,682	119,201,515
1879	6,658	98,149,053	1893	15,242	346,779,889	1907	11,725	197,385,225
1880	4,735	65,752,000	1894	13,885	172,992,856	1908	15,690	222,315,684
1881	5,582	81,155,932	1895	13,197	173,196,060	1909	15,924	154,603,465
1882	6,738	101,547,564	1896	15,088	226,096,834	1910	12,652	201,757,097
1883	9,184	172,874,172	1897	13,351	154,332,071	1911	13,441	191,061,665

Courtesy of Dun's Review.

COINAGE OF THE UNITED STATES MINTS.

The total coinage of gold in the United States mints for the year ending December 31, 1911 was $56,176,822.50; the total coinage of silver for the same period amounted to $6,457,301.55 and the total coinage of minor metals to $3,156,726.47. Thus the total coinage of the United States Mints amounted to $65,790,850.52.

PRICES OF THE LEADING ARTICLES OF GRAIN, GROCERIES AND PROVISIONS IN NEW YORK MARKET.

[Sources: Coffee, Mr. Louis Seligsberg, New York; Sugar, Messrs. Willett & Gray; other figures, Mr. Henry Heinzer, statistician, New York Produce Exchange.]

Calendar year.	Wheat, No. 2, red winter, per bushel.	Corn, No. 2, mixed, per bushel.	Oats, No. 2, mixed, per bushel.	Lard, prime contract, per pound.	Beef, extra mess, per barrel.	Pork, mess, per barrel.	Tallow, prime, per pound.	Coffee.			Sugar.		
								Brazil, fair to prime,[1] per pound.	No. 7, Exchange standard, per pound.	Java, per pound.	Raw, centrifugals, per pound.	Soft, standard A, per pound.	Hard, granulated, per pound.
	Dolls.	*Cents.*	*Cents.*	*Cents.*	*Dolls.*	*Dolls.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1890.....	0.983	48.1	28.9	6.33	6.96	12.13	4.59	19.43	18.03	24.37	5.57	6.00	6.27
1891.....	1.094	70.4	46.0	6.59	8.35	11.38	4.81	17.80	16.40	24.50	3.92	4.47	4.65
1892.....	.908	54.0	36.3	7.69	6.86	11.52	4.62	15.83	14.43	26.37	3.32	4.21	4.35
1893.....	.739	49.9	35.9	10.34	8.17	18.35	5.44	18.82	17.42	24.23	3.69	4.72	4.84
1894.....	.611	50.9	37.2	7.75	8.16	14.13	4.81	17.81	16.41	23.25	3.24	4.00	4.12
1895.....	.669	47.7	28.9	6.50	8.09	11.91	4.33	17.80	15.80	26.60	3.23	4.00	4.12
1896.....	.781	34.0	23.3	4.67	7.51	8.95	3.44	15.05	12.15	23.44	3.62	4.41	4.53
1897.....	.954	31.9	23.2	4.42	7.71	8.85	3.31	11.96	9.80	24.00	3.56	4.38	4.50
1898.....	.952	37.6	29.7	5.53	9.16	9.82	3.56	8.00	6.80	24.00	4.24	4.84	4.97
1899.....	.794	41.3	30.7	5.57	9.26	9.35	4.54	7.45	6.25	24.00	4.42	4.80	4.92
1900.....	.804	45.3	27.3	7.05	9.73	12.48	4.84	9.50	8.30	22.00	4.57	5.12	5.32
1901.....	.803	56.7	36.6	8.87	9.32	15.62	5.25	8.60	7.38	17.00	4.05	4.85	5.05
1902.....	.836	68.4	44.9	10.59	11.75	17.94	6.31	6.75	5.65	16.00	3.54	4.27	4.46
1903.....	.853	57.2	41.1	8.81	9.03	16.50	5.06	6.75	5.50	15.75	3.72	4.48	4.64
1904.....	1.107	59.4	42.0	7.32	8.82	14.01	4.60	8.80	7.70	15.00	3.97	4.62	4.77
1905.....	1.028	59.3	35.0	7.44	10.02	14.43	4.50	9.15	8.25	15.00	4.28	5.11	5.26
1906.....	.865	56.0	38.0	8.88	8.85	17.55	5.31	9.25	8.10	14.50	3.69	4.37	4.52
1907.....	.963	64.0	49.6	9.20	9.83	17.61	6.25	8.85	6.60	16.50	3.76	4.45	4.65
1908.....	1.04⅞	78.6	54.5	9.08	13.20	15.93	5.50	7.85	6.25	18.50	4.07	4.76	4.96
1909.....	1.263	76.7	51.4	11.68	11.09	21.34	6.00	8.75	7.85	18.00	4.00	4.56	4.76
1910.....	1.118	66.8	.....	12.52	14.64	23.72	7.25	10.15	9.60	18.00	4.19	4.77	4.97
1911.....	96.3	71.1	[2] 45.7	9.11	12.92	19.12	6.50	14.35	13.25	18.75	4.453	5.145	5.345

[1] No. 3, Exchange standard.

[2] No. 2 white oats.

ESTIMATED STOCK OF GOLD AND SILVER IN THE UNITED STATES.

At the end of the fiscal year June 30, 1911, the population of the United States was 93,983,000, against 76,891,000 in 1900, 62,622,250 in 1890, 50,155,783 in 1880, and 41,677,000 in 1873. The total stock of gold coin and bullion in 1911 was $1,753,134,114, against $1,034,439,264 in 1900, $695,563,029 in 1890, $351,841,206 in 1880, and $135,000,000 in 1873. The total stock of silver coin and bullion in 1911 amounted to $732,002,448, against $647,371,030 in 1900, $463,211,919 in 1890, $148,522,678 in 1880, and $6,149,305 in 1873. The amount of gold per capita in the United States at the end of the fiscal year June 30, 1911, was $18.65, against $13.45 in 1900, $11,10 in 1890, $7.01 in 1880, and $3.23 in 1873. At the end of this same period the supply of silver per capita was $7.79, against $8.42 in 1900, $7,39 in 1890, $2.96 in 1880, and $0.15 in 1873.

RESOURCES AND LIABILITIES OF NATIONAL BANKS IN 1911.

The resources of the 7,301 National Banks in the United States on September 1, 1911, which amounted to a grand total of 10,379.4 million dollars, were derived from the following sources: Loans and discounts, inclusive of overdrafts, 5,690.6 million dollars; bonds for circulation 707.2 millions; other United States bonds and other bonds for deposits 74.7 millions; bonds, securities, etc., 1,018 millions; due from banks and reserve agents 1,306.4; real estate, banking house, etc., 256.4 millions; specie 711.5 millions; legal tender notes 183.9 millions; bills of other banks 42.6 millions; clearing-house exchanges 298.2 millions; due from United States Treasurer 42.5 millions; and other resources 47.4 millions.

Their liabilities for the same period, totaling 10,379.4 million dollars, were as follows: Capital stock 1,025.4 millions; surplus fund 670 millions; undivided profits 234.4 millions; national bank circulation 697 millions; individual deposits 5,490 millions; due to bank and reserve agents 2,088.2 millions; and other liabilities 174.4 million dollars.

Summary of Relative Prices of Commodities, 1890 to 1910, by Groups.

[Average price for 1890–1899=100.]

Years.	Farm products.	Food, etc.	Cloths and clothing.	Fuel and lighting.	Metals and implements.	Lumber and building materials.	Drugs and chemicals.	House furnishing goods.	Miscellaneous.	All commodities.
1890	110.0	112.4	113 5	104.7	119 2	111.8	110.2	111 1	110.3	112.9
1891	121 5	115.7	111 3	102.7	111 7	108.4	103 6	110.2	109.4	111.7
1892	111 7	103.6	109.0	101.1	106.0	102.8	102.9	106.5	106.2	106.1
1893	107 9	110.2	107.2	100.0	100.7	101.9	100.5	104.9	105.9	105.6
1894	95.9	99.8	96.1	92.4	90.7	96.3	89.8	100.1	99.8	96.1
1895	93.3	94.6	92.7	98.1	92.0	94.1	87.9	96.5	94.5	93.6
1896	78.3	83.8	91.3	104.3	93.7	93.4	92.6	94.0	91.4	90.4
1897	85.2	87.7	91.1	96.4	86.6	90.4	94.4	89.8	92.1	89.7
1898	96.1	94.4	93.4	95.4	86.4	95.8	106.6	92.0	92.4	93.4
1899	100.0	98.3	96.7	105.0	114.7	105.8	111.3	95.1	97.7	101.7
1900	109 5	104.2	106.8	120.9	120.5	115.7	115.7	106.1	109.8	110.5
1901	116.9	105.9	101.0	119.5	111 9	116.7	115.2	110.9	107.4	108.5
1902	130.5	111.3	102.0	134.3	117.2	118.8	114.2	112.2	114.1	112.9
1903	118.8	107 1	106.6	149.3	117.6	121.4	112.6	113.0	113.6	113 6
1904	126 2	107.2	109.8	132.6	109.6	122.7	110.6	111.7	111.7	113.0
1905	124.2	108.7	112.0	128.8	122.5	127.8	109.1	109.1	112.8	115.9
1906	123 6	112.6	120.0	131 9	135.2	140.1	101 2	111.0	121.1	122.5
1907	137 1	117 8	126.7	135.0	143.4	146.9	109.6	118.5	127.1	129.5
1908	133 1	120.6	116.9	130.8	125.4	133.1	110.4	114.0	119.9	122.8
1909	153.1	124 7	119.6	129.3	124.8	138.4	112.4	111.7	125.9	126.5
1910	164.6	128.7	123.7	125.4	128 5	153.2	117.0	111 6	133.1	131.6

From the Report of the Director of the Mint.

CASUALTY AND SURETY INSURANCE BUSINESS IN 1911.

The business of Companies doing a miscellaneous insurance business in the United States during the year 1911 was divided as follows: Automobile business, $2,676,767 received from premiums, $1,129,193 paid for losses; burglary, $2,850,344 received from premiums, $1,110,978 paid for losses; credit, $1,752,582 received from premiums, $1,056,133 paid for losses; fidelity and surety, $16,958,051 received from premiums, $4,980,430 paid for losses; health, $7,101,666 received from premiums, $3,314,301 paid for losses; liability, $35,201,753 received from premiums, $20,341,029 paid for losses; personal accident, $27,351,626 received from premiums, $11,837,347 paid for losses; plate glass, $3,960,546 received from premiums, $1,714,236 paid for losses; steam boiler, $2,246,225 received from premiums, $282,338 paid for losses; sprinkler business, $178,016 received from premiums, $73,438 paid for losses; flywheel, $184,514 received from premiums, $75,704 paid for losses; live stock, $572,564 received from premiums, $267,315 paid for losses; workmen's collective, $711,726 received from premiums, $306,433 paid for losses. Courtesy Spectator Ins. Year Book.

The first fire insurance company in the United States was established in Boston, Mass. by the Sun Insurance Company (English) in 1728. The first fire insurance policy was issued in Hartford, Conn., 1794. First accident insurance company established at Hartford, Conn., 1863.

Gold and Silver Currency and Total Money in the Treasury and in Circulation.

At the close of the fiscal year 1911 the gold in the United States was divided as follows: Coin and bullion in the Treasury $233,533,255, and in circulation $589,295,538; and certificates in circulation $930,367,929. Thus the total amount of gold in the United States was $1,753,196,722.

The silver of the United States, for the same year, was divided as follows: Standard dollars in the Treasury $39,043,622, and in circulation $72,446,049; certificates in circulation $453,543,696; and subsidiary coin in the Treasury $21,185,641, and in circulation $138,421,723. Thus the number of standard dollars and of certificates in circulation amounted to $565,033,367, and the amount of subsidiary coin to $159,607,364.

Aggregate Savings Deposits of Savings Banks, Number of Depositors, and Average Amount Due to Each Depositor: Year Ended June 30, 1911.

At the end of the fiscal year 1911 there were 1,884 Savings Banks in the United States [This includes only mutual and stock savings banks transacting chiefly a savings bank business] and they had depositors to the number of 9,597,185. The total amount of the deposits for that year was $4,212,583,598.53 or an average deposit to each depositor of $438.93.

PRINCIPAL STEAMSHIP ROUTES FROM NORTH AMERICA.

Courtesy of "The Sphere."

FORMATION AND DEATH OF ICEBERGS.

AMOUNTS OF GOLD AND SILVER COIN AND CERTIFICATES, UNITED STATES NOTES, AND NATIONAL-BANK NOTES IN CIRCULATION AND IN THE TREASURY APR. 1 AND MAY 1, 1912, RESPECTIVELY.

[Compiled from statements of the Treasury Department.]

CLASSIFICATION.	GENERAL STOCK OF MONEY IN THE UNITED STATES.		HELD IN TREASURY AS ASSETS OF THE GOVERNMENT.[1]		MONEY IN CIRCULATION			
	Apr. 1, 1912.	May 1, 1912.	Apr. 1, 1912.	May 1, 1912.	Apr. 1, 1912.	May 1, 1912.	May 1, 1911.	Jan. 1, 1879.
	Dollars.	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*	*Dollars.*
Gold coin (including bullion in Treasury)	[2] 1,798,389,525	1,810,515,781	172,841,816	170,858,482	597,115,340	605,360,930	589,433,525	96,262,850
Gold certificates [3]			81,295,114	82,329,040	947,137,255	951,967,329	934,405,509	21,189,280
Standard silver dollars	565,269,367	565,301,367	7,577,904	8,693,971	70,528,463	70,416,396	73,055,403	5,790,721
Silver certificates [3]			12,307,624	10,883,976	474,855,376	475,307,024	466,021,123	413,360
Subsidiary silver	[4] 165,073,658	165,763,883	24,306,074	24,738,979	140,767,584	141,024,904	137,604,117	67,982,601
Treasury notes of 1890	3,010,000	2,978,000	11,004	8,183	2,998,996	2,969,817	3,310,257	
United States notes	346,681,016	346,681,016	8,880,271	9,625,444	337,800,745	337,055,572	336,020,489	[5] 310,288,511
National-bank notes	744,871,283	745,720,348	34,887,276	33,623,681	709,984,007	712,096,667	697,787,694	314,339,398
Total	3,623,294,849	3,636,960,395	342,107,083	340,761,756	3,281,187,766	3,296,198,639	3,237,638,117	816,266,721
Circulation per capita					34.45	34.56	34.55	[6] 16.75

[1] This statement of money held in the Treasury as assets of the Government does not include deposits of public money in national-bank depositaries to the credit of the Treasurer of the United States, amounting to $34,338,503.18.

[2] A revised estimate by the Director of the Mint of the stock of gold coin was adopted in the statement for Aug. 1, 1907. There was a reduction of $135,000,000.

[3] For redemption of outstanding certificates an exact equivalent in amount of the appropriate kinds of money is held in the Treasury, and is not included in the account of money held as assets of the Government.

[4] A revised estimate by the Director of the Mint of the stock of subsidiary silver coin was adopted in the statement of Sept. 1, 1910. There was a reduction of $9,700,000.

[5] Includes $33,190,000 currency certificates, act June 8, 1872.

[6] July 1.

RESOURCES AND LIABILITIES OF SAVINGS, STATE AND PRIVATE BANKS AND LOAN AND TRUST COMPANIES FOR THE YEAR ENDED JUNE 30, 1911.

The 1,884 Savings Banks in the United States at the end of the fiscal year 1911 had resources and liabilities amounting to the grand total of $4,652,313,302.62. For the same period the 12,843 State Banks had resources and liabilities amounting to $3,747,786,296.35; the 1,116 Private Banks for that year had resources and liabilities to the amount of $182,824,220.68; and the 1,251 Loan and Trust Companies had total liabilities and resources amounting to $4,665,110,868.71.

PEOPLE OF NO DISTINCTIVE RACE

The Basques in the western Pyrenees of France and Spain, about 60,000, probably descendants and remnants of the old Iberians; the Dravidians about 60 millions in Hindustan, and the Deccan, the presumed primitive race of India, with the Tribes Gondas, Kolapoors, Telugas, Tamils, etc.; the inhabitants of the Arctic regions of Asia and North America, the Kamtchadales, Yukagirs, Eskimo, Tchooktchees, Aleutians.; the Hottentots and Bushmen (Korana, Griequa, Namaqua, etc.) in southwest Africa; the Gipsies, a peculiar nomadic tribe scattered over the whole of Europe, west Asia and Africa.

SUMMARY OF TRANSACTIONS OF THE POSTAL SAVINGS SYSTEM IN 1911: BY MONTHS.

[Source: Post Office Department.]

Month.	Number of offices at close of month.	Deposits.	Withdrawals.	Balance to credit of depositors.	Savings cards and stamps.			Net cash receipts to close of month.	Balance on deposit in banks.
					Sold.	Converted into Deposits.	Outstanding at close of month		
		Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
January	48	61,805	1,704	60,101	980.40	429.00	551.40	60,652.40	.....
February	48	81,758	7,990	133,869	822.50	402.00	971.90	134,922.90	110,844.38
March	48	80,701	12,609	201,961	652.80	498.00	1,126.70	203,287.00	191,878.97
April	48	82,646	16,165	268,442	398.30	338.00	1,187.00	269,814.00	264,508.32
May	93	154,505	28,010	394,931	735.10	581.00	1,341.10	396,440.10	381,977.90
June	400	316,714	34,500	677,145	1,236.60	690.00	1,887.70	679,310.40	571,670.90
July	1,000	578,817	73,907	1,182,055	2,911.90	1,851.00	2,948.60	1,189,384.73	973,390.73
August	1,280	1,175,618	184,819	2,172,854	7,689.30	3,936.00	6,701.90	2,184,542.91	1,535,137.50
September	1,973	2,185,438	282,645	4,075,647	12,891.70	6,720.00	12,873.60	4,095,768.66	2,993,018.77
October	3,148	2,837,918	473,304	6,440,261	17,216.50	11,330.00	18,760.10	6,465,399.84	5,439,713.24
November	4,185	2,911,476	671,763	8,679,974	18,139.40	12,844.00	24,055.50	8,714,249.44	8,026,847.08
December	5,185	2,919,872	985,170	10,614,676	14,429.20	14,725.00	23,759.70	11,073,236.77	9,668,301.52

Quick Method for Calculating Interest

Where the Time is for Days Only

Rule.—To find the interest on any given sum for any number of days multiply the principal by the number of days, and divide as follows: At 5%, divide by 72; at 6%, divide by 60; at 7%, divide by 52; at 8%, divide by 45; at 9%, divide by 40.

Table of Days for Computing Interest

To Find the Number of Days from any Day of any one Month to the same Day of any other Month

From	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
To January.	365	334	306	275	245	214	184	153	122	92	61	31
February	31	365	337	306	276	245	215	184	153	123	92	62
March...	59	28	365	334	304	273	243	212	181	151	120	90
April...	90	59	31	365	335	304	274	243	212	182	151	121
May....	120	89	61	30	365	334	304	273	242	212	181	151
June...	151	120	92	61	31	365	335	304	273	243	212	182
July....	181	150	122	91	61	30	365	334	303	273	242	212
August..	212	181	153	122	92	61	31	365	334	304	273	243
Septem'r	243	212	184	153	123	92	62	31	365	335	304	274
October..	273	242	214	183	153	122	92	61	30	365	334	304
Nove'ber	304	273	245	214	184	153	123	92	61	31	365	335
Dece'ber	334	303	275	244	214	183	153	122	91	61	30	365

N.B.—In leap year, if the last day of February comes between, add one day to the number in the table

Example.—How many days from May 10th to Sept. 13th? From the above table we get 123; add 3 for difference between 10 and 13, and we get 126, the number of days required.

Table Showing Rate of Income on Stocks

Purchased at the Following Prices (Par Value Being $1.00) and Bearing Interest at the Following Rates

Paid	4%	5%	6%	7%	8%	9%	10%
$80	5.	6.25	7.50	8.75	10.	11.25	12.50
90	4.44	5.55	6.66	7.77	8.88	10.	11.11
95	4.21	5.26	6.31	7 36	8.42	9.47	10.52
105	3.80	4.76	5.71	6.66	7.61	8.57	9.52
110	3.63	4.54	5.45	6.36	7.27	8.18	9.09
115	3.47	4.34	5.21	6.08	6.95	7.82	8.69
120	3.33	4.16	5.	5.83	6.66	7.50	8.33
125	3.20	4.	4.80	5.60	6.40	7.20	8.
126	3.17	3.96	4.76	5.55	6.34	7.14	7.93
127	3.14	3.93	4.72	5.51	6.29	7.08	7.87
128	3.12	3.90	4.68	5.46	6.25	7.03	7.81
129	3.10	3.87	4.65	5.42	6.20	6.97	7.75
130	3.07	3.84	4.61	5.38	6.15	6.92	7 69
131	3.05	3.81	4.58	5.34	6.10	6.87	7.63
132	3.03	3.78	4.54	5.30	6.06	6.81	7.57
133	3.	3.75	4.51	5.26	6.01	6.76	7.51
134	2.98	3.73	4.47	5.22	5.97	6.71	7.46
135	2.96	3.70	4.44	5.18	5.92	6.66	7.40
136	2.94	3.67	4.41	5.14	5.88	6.61	7.35
137	2.91	3.63	4.37	5.10	5.83	6.56	7.29
138	2.89	3 62	4.34	5.07	5.79	6.52	7.24
139	2.87	3.59	4.31	5.03	5.76	6.47	7.19
140	2.85	3.57	4.28	5.	5.71	6.42	7.14
141	2.83	3.54	4.25	4.96	5.67	6 38	7.09
142	2.81	3.52	4.22	4.92	5.63	6.33	7.04
143	2.79	3.49	4.19	4.89	5.59	6.29	6.99
144	2.77	3.47	4.16	4.86	5.55	6.25	6.94
145	2.75	3.44	4.13	4.82	5.51	6.20	6.89
146	2.73	3.42	4.10	4.79	5.47	6.16	6.84
147	2.72	3.40	4.08	4.76	5.44	6.12	6.80
148	2.70	3.37	4.05	4.72	5.40	6.08	6.75
149	2.68	3.35	4.02	4.69	5.36	6.04	6.71
150	2.66	3.33	4.	4.66	5.33	6.	6.66
155	2.58	3.22	3.87	4 51	5.16	5.80	6.45
160	2.50	3.12	3.75	4.37	5.	5.62	6.25
165	2.42	3.03	3.63	4.24	4.84	5.45	6.06
170	2.35	2.94	3.52	4.11	4.70	5.29	5.88

PRINCIPAL STEAMSHIP ROUTES FROM SOUTH AMERICA.

Ocean Marine Insurance.

Twenty-five marine insurance companies reporting to the New York State Insurance Department had on January 1, 1912 assets of $34,043,458, surplus of $15,274,675, and premiums received in preceding year $13,774,722, losses paid $5,450,267, risks written to policy holders $10,395,373,098.

The first savings banks in the United States were established at Boston and Philadelphia in 1816 and in New York in 1819. The postal savings bank system was established by an Act of Congress June 25, 1910, and on Jan. 3, 1911 one city in each state was selected for the opening of the first postal savings banks,

NOTABLE CONFLAGRATIONS IN THE WORLD'S HISTORY.

From "The Insurance Year Book," published by "The Spectator Company."

Even before man began to congregate and build cities, there existed the danger of prairie and forest fires; but these, except in a minor way, were not especially destructive of other property. When cities had been built and many thousands of people came to be housed within a small area, the danger of fire and its capacity for doing harm to men and their property were greatly augmented; and as cities increased in size, the fire hazard and the accumulated values subject to destruction were both correspondingly multiplied. During the last four thousand years many cities have been swept by fire, some of them several times: and some have been practically obliterated. Below will be found a list, compiled from various sources, of some of the more important fires of history, comprising those most notable because of the values or lives destroyed, or for some peculiar reason:

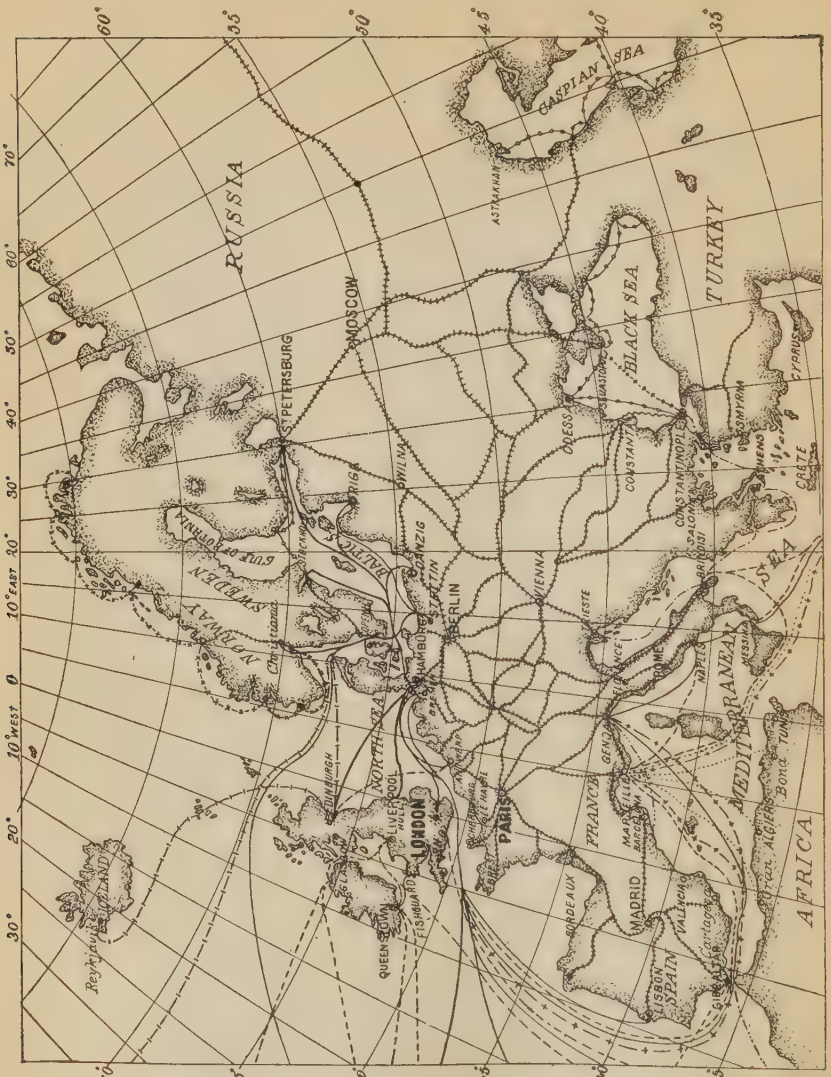
Year.	Location.
B.C.	
1897	Sodom and Gomorrah
1400	Jerusalem
1141	Ephesus
586	Jerusalem
480	Plataea
497	Athens
390	Rome
241	Rome
215	Rome
212	Rome
146	Corinth
50	Rome
48	Alexandria
13-14	Rome
12	Rome
A. D.	
59	Lyons
64	Rome
70	Jerusalem
80	Rome
154	Rome
154	Antioch
188	Rome
197	Lyons
260	Bordeaux
273	Alexandria
393	Constantinople
465	Constantinople
532	Constantinople
558	Paris
640	Alexandria
667	Rochester
741	York Minster
781	Constantinople
798	London
802-7	Constantinople
807	Peterborough
893	London
917	Cordova
978	Cork
982	London
1004	Norwich
1010	Northampton
1013	Cork
1069	York
1086	London
1087	London
1092	London
1102	Winchester
1106	Venice
1113	Mons
1113	Worcester
1116	Bath
1118	Nantes

Year.	Location.
A. D.	
1123	Lincoln
1130	Rochester
1135	London
1137	York
1137	Bath
1140	Nottingham
1171	Canterbury
1171	Cairo
1189	Carlisle
1190	Dublin
1203	Constantinople
1204	Doncaster
1215	Bruges
1283	Dublin
1292	Carlisle
1299	Westminster
1321	Geneva
1327	Munich
1333	Geneva
1349	Newcastle-upon-Tyne
1385	Edinburgh
1388	Dunkirk
1401	Edinburgh
1405	Berne
1405	Brussels
1430	Geneva
1471	Chester
1491	Dresden
1507	Norwich
1512	Brest
1542	Edinburgh
1544	Edinburgh
1570	Moscow
1576	Antwerp
1612	Cork
1631	Magdeburg
1633	Constantinople
1656	Jeddo
1666	London
1667	Archangel
1675	Northampton
1676	Southwark
1682	Wapping, London
1689	Prague
1692	Salem
1694	Warwick
1694	Dieppe
1700	Charleston
1702	Bergen
1728	Copenhagen
1729	Constantinople
1731	Baireuth
1736	Peasmore
1737	Panama

Year.	Location.
A. D.	
1737	Moscow
1737	Jaroslaw
1738	Martinique
1742	Smyrna
1744	Brest
1745	Constantinople
1748	Moscow
1749	Constantinople
1750	Constantinople
1750	Moscow
1751	Constantinople
1752	Moscow
1753	Smyrna
1753	Archangel
1756	Berghen
1756	Constantinople
1758	Savannah
1759	Salonica
1760	Boston
1764	Königsberg
1765	Belgrade
1769	Konigsberg
1769	Constantinople
1769	St. John's
1771	Constantinople
1771	St. Petersburg
1772	Smyrna
1773	Moscow
1775	Limehouse
1775	St. George
1776	St. Kitts
1776	New York
1777	New Orleans
1778	Charleston
1778	New York
1778	Constantinople
1780	St. Petersburg
1780	St. Petersburg
1782	Constantinople
1782	Constantinople
1784	Port-au-Prince
1784	Brest
1784	Constantinople
1784	Rokitzan, Bohemia
1790	Carlscrona
1791	Constantinople
1792	Constantinople
1793	Archangel
1794	Copenhagen
1794	Wapping, London
1795	Copenhagen
1795	Constantinople
1796	Smyrna
1796	Barbados

NOTABLE CONFLAGRATIONS IN THE WORLD'S HISTORY—Continued.

Year.	Location.
A. D.	
1796	Baltimore
1797	Scutari
1798	Wilmington
1799	Peru
1799	Constantinople
1799	Manila
1802	Liverpool
1803	Bombay
1805	St. Thomas
1808	Spanish T'n, Trinidad
1811	Smyrna
1812	Moscow
1814	Rangoon
1816	Constantinople
1817	Pt. Louis, Mauritius
1818	Constantinople
1820	Canton
1820	Savannah, Ga.
1820	Paris
1820	Port-au-Prince
1821	Paramaribo
1822	Canton
1824	Cairo
1825	New Brunswick
1826	St. John's, N. F.
1826	Constantinople
1827	Abo, Finland
1831	Constantinople
1831	Bristol
1831	St. Thomas, W. I.
1833	Manila
1833	Constantinople
1834	Houses of Parliament, London
1835	New York
1836	Constantinople
1837	Surat
1837	St. Petersburg
1837	Naples
1838	Charlestown
1839	New York
1841	Smyrna
1842	Hamburg
1842	Liverpool
1845	Quebec
1845	Smyrna
1845	New York
1846	St. John's, N. F.
1846	Albany
1848	Orel, Russia
1848	Constantinople
1848	Albany, N. Y.
1849	St. Louis
1851	San Francisco
1851	San Francisco
1853	Montreal
1853	Sacramento City
1853	Constantinople
1854	Gateshead
1858	Astrakan
1858	Valparaiso
1858	Auckland
1859	Key West
1859	St. Louis
1859	Constantinople
1860	Barbadoes
1861	Mendoza, S. A.
1861	Limoges
1861	London
1861	Charleston
1862	Enschede, Holland
1862	Troy
1862	St. Petersburg
1862	Marseilles
1862	Constantinople
1863	Monastir
1864	Georgetown
1864	Hankow
1865	Port-au-Prince
1865	New York
1865	Constantinople
1865	Manila
1866	London
1866	Portland, Me.
1866	Quebec
1866	Yokahama
1868	Charleston, S. C.
1868	Albany, N. Y.
1869	Philadelphia
1870	Constantinople
1870	Pera, Turkey
1870	Sam-Sun, Turkey
1870	Chicago
1871	Chicago
1872	Constantinople
1872	Boston
1873	Alexandra Palace, London
1873	Havana
1874	Constantinople
1874	Pimlico, London
1874	Chicago
1875	Oshkosh
1875	Virginia City
1875	Iquique
1876	St. John's
1876	Soderhamn, Sweden
1876	Quebec
1876	St. Hyacinth
1877	St. John, N. B.
1877	Pittsburgh
1879	Irkutsk, Siberia
1879	New York
1879	Boston
1882	Kingston, Jamaica
1882	Colorado
1882	Wood Street, London
1883	Vienna
1884	Bayswater, London
1885	Aspinwall
1887	Paris
1887	Exeter, England
1888	Sundsvall
1889	Seattle
1889	New York
1889	Spokane
1889	Boston
1889	Lynn
1890	Fort de France, Martinique
1890	Sydney
1892	New Orleans
1892	New Orleans
1892	Tokio
1892	Milwaukee
1892	St. John's, N. F.
1893	Boston
1894	Shanghai
1894	Canton, China
1896	Guayaquil
1897	Melbourne
1897	London
1897	London
1897	Paris
1898	Nijni-Novgorod
1899	Philadelphia
1900	Hoboken
1900	Bayonne
1900	Ottawa-Hull, Canada
1901	Jacksonville
1901	Antwerp
1901	Montreal
1902	Paterson
1902	Waterbury
1904	Baltimore
1904	Aesland, Norway
1904	Toronto
1904	Halifax
1904	Rochester
1905	New Orleans
1906	San Francisco
1906	Valparaiso, Chile
1906	Wellington, N. Z.
1907	Iquique, Chile
1907	Hakodate, Japan
1907	Kingston, Jamaica
1908	Chelsea, Mass.
1908	Noda Soy, Japan
1908	Niigata, Japan
1908	Chisholm, Minn.
1908	Port-au-Prince, Hayti
1908	Paris, France
1908	El Oro, Mexico
1908	Rostov-on-Don, Russia
1909	Acapulco, Mexico
1909	Osaka, Japan
1909	Valdivia, Chile
1909	London, England
1910	Campbellton, N. B.
1910	Wajima, Japan
1910	Brussels, Belgium
1910	U. S. and Canada forest fires
1911	Santiago, Chile
1911	Aux Cayes, Hayti
1911	Tokio, Japan
1911	Yamagata, Japan
1911	Bangor, Me.
1911	N. Y., "Triangle"
1911	Albany, N. Y.
1911	Kirin, Manchuria
1911	Constantinople
1911	Hankow, China
1911	Nanking, China
1912	Peking, China
1912	Osaka, Japan
1912	N. Y., "Equitable"
1912	Valdivia, Chile
1912	Tien-Tsin, China
1912	Pao Ting Fu, China
1912	Tokio, Japan
1912	Damascus, Syria
1912	Constantinople
1912	Castellon, Spain



PRINCIPAL STEAMSHIP ROUTES FROM EUROPE.

FIRES, URBAN AND RURAL, IN THE UNITED STATES: NUMBER, LOSS ON BUILDINGS AND CONTENTS, BY KINDS OF BUILDINGS, AND LOSS PER CAPITA, CALENDAR YEAR 1907.

[Source: Report of the Geological Survey, Department of the Interior.]

	Urban.	Rural.	Total.
Fire loss:			
Brick, etc., buildings—	*Dollars.*	*Dollars.*	*Dollars.*
Buildings	19,816,474	11,276,213	31,092,687
Contents	29,092,270	8,240,310	37,332,580
Total	48,908,744	19,516,523	68,425,267
Frame buildings—			
Buildings	30,357,151	47,707,056	78,064,207
Contents	27,827,388	40,767,847	68,595,235
Total	58,184,539	88,474,903	146,659,442
Totals:			
Buildings	50,173,625	58,983,269	109,156,894
Contents	56,919,658	49,008,157	105,927,815
Grand total	107,093,283	107,991,426	215,084,709
Number of fires:			
In brick, etc., buildings	25,297	10,843	36,140
In frame buildings	80,109	49,008	129,117
Total	105,406	59,851	165,257
Loss per capita	2.54	2.49	2.51

FIRES IN THE UNITED STATES: POPULATION, LOSS AND PER CAPITA LOSS, BY GEOGRAPHIC DIVISIONS, CALENDAR YEAR 1907.

[Source: Report of the Geological Survey, Department of the Interior.]

Geographic division.	Total population.	Total fire loss.	Fire loss per capita.
North Atlantic:			
Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania	23,779,013	*Dollars.* 59,447,532	*Dollars.* 2.50
South Atlantic:			
Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida	11,574,988	25,349,223	2.19
North Central:			
Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas	29,026,645	68,793,148	2.37
South Central:			
Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas	16,368,558	59,908,922	3.66
Western:			
Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Washington, Oregon, and California	4,783,557	12,676,426	2.65

TOTAL WATER SURFACE.

		Sq. Miles.	Fathoms Depth.	
			Max.	Average.
The Pacific Ocean	48 p. c.	67,570,000	5,350	2,100
" Atlantic Ocean	24 p. c.	34,700,000	4,730	1,800
" Indian Ocean	21 p. c.	28,900,000	3,830	2,000
" Arctic Sea	3 p. c.	4,470,000	2,650	1,500
" Antarctic Sea	4 p. c.	5,610,000	3,130	1,600

ANNUAL FIRE LOSSES IN THE UNITED STATES FOR THIRTY-SEVEN YEARS—1875-1911

[*Mainly from the Chronicle Fire Tables. Courtesy of "The Spectator."*

Year.	Aggregate Property Loss.	Aggregate Insurance Loss.	Year.	Aggregate Property Loss.	Aggregate Insurance Loss.
1875.....	$78,102,285	$39,327,400	1894.....	$140,006,484	$89,574,699
1876.....	64,630,600	34,374,500	1895.....	142,110,233	84,689,030
1877.....	68,265,800	37,398,900	1896.....	118,737,420	73,903,800
1878.....	64,315,900	36,575,900	1897.....	116,354,575	66,722,145
1879.....	77,703,700	44,464,700	1898.....	130,593,905	73,796,080
1880.....	74,643,400	42,525,000	1899.....	153,597,830	92,683,715
1881.....	81,280,900	44,641,900	1900.....	160,929,805	95,403,650
1882.....	84,505,024	48,875,131	1901.....	165,817,810	100,798,645
1883.....	100,149,228	54,808,664	1902.....	161,488,355	94,775,045
1884.....	110,008,611	60,679,818	1903.....	145,302,155	*104,000,000
1885.....	102,818,796	57,430,709	1904.....	†229,198,050	*144,000,000
1886.....	104,924,750	60,506,564	1905.....	†165,221,650	*116,000,009
1887.....	120,283,055	69,659,508	1906.....	†518,611,800	*292,000,000
1888.....	110,885,665	63,965,724	1907.....	†215,084,709	*127,000,000
1889.....	123,046,833	73,679,465	1908.....	†217,885,850	*157,000,000
1890.....	108,993,792	65,015,465	1909.....	†188,705,150	*143,000,000
1891.....	143,764,967	90,576,918	1910.....	†214,003,300	*175,000,000
1892.....	151,516,098	93,511,936	1911.....	†217,004,575	*190,000,000
1893.....	167,544,370	105,994,577	Totals..	$5,337,215,795	$3,345,359,583

*Estimated by publishers of the Insurance Year Book
†From National Board Tables.

FINANCIAL STANDING OF LIFE INSURANCE COMPANIES.

The combined aggregates of the Financial Standing, etc., of the 214 principal insurance companies show that the capital stock in 1910 was $40,544,728. The principal sources of income of these companies for the same period were as follows: New premiums, $70,180,419; renewed premiums, $517,535,978; received for annuities, $5,671,844; dividends, interest, etc., $160,513,917; received for rents, $10,309,988; and all other receipts, $16,799,103; thus making the total income $781,011,249. The expenditures of these same companies for the same period were as follows: Paid for death losses, $180,654,396; paid for matured endowments, $46,349,075; annuities paid, $7,426,499; paid for surrendered, lapsed and purchased policies, $77,518,465; dividends to policyholders, $75,355,638; dividends to stockholders, $2,140,037; commissions, salaries and traveling expenses of agents, $87,628,519; medical fees, salaries and other charges of employees, $26,036,575; and all other expenditures, $37,235,222; thus making the total expenditures of the companies $540,342,426. The excess of the income over the expenditures for the year 1910 amounted to $240,668,823.

The assets, amounting to $3,875,877,059 of admitted assets and $25,185,764 of assets not admitted, were divided as follows: Real estate owned, $172,960,857; bond and mortgage loans, $1,227,231,592; bonds owned, $1,659,845,447; stocks owned, $129,622,493; collateral loans, $18,941,120; premium notes and loans, $495,099,854; cash in office and banks, $71,112,566; net deferred and unpaid premiums, $50,955,665; and all other assets, $50,107,465. The liabilities of these same companies, amounting to $3,385,821,478, were divided as follows: Reserve, $3,225,966,060; losses and claims not paid, $17,072,212; claims resisted, $1,779,117; dividends unpaid, $79,990,050; and all other liabilities, $61,014,039. The total surplus paid to policyholders amounted to $490,055,571.

The policy account of these companies is as follows: New business actually paid for, $1,822,260,287; whole life policies in force, $8,816,663,388; endowment policies in force, $3,042,585,983; and all other policies in force, $1,367,963,797. The total insurance in force in these companies amounted to $13,227,213,168; the industrial business written to $734,793,180; and the industrial insurance in force to $3,177,047,874.

Spectator Insurance Year Book.

At the end of the calendar year 1910 there were 5,937 Building and Loan Associations in the United States having assets to the sum of $945,568,907 and a membership of 2,216,912.

The first steam fire engine was invented by Braithwaite, 1829; Ericsson, in New York, produced a similar one in 1840. They were not generally used until 1860. Fire engines driven by motor power first used in 1905.

FIRE, MARINE AND CASUALTY INSURANCE.

FIRE AND MARINE CASUALTY AND MISCELLANEOUS INSURANCE IN THE UNITED STATES IN 1890, AND FROM 1895 TO 1910. TOTAL INCOME OF COMPANIES AND PAYMENTS TO POLICY HOLDERS.

Data furnished by "The Spectator" Company, New York.

Fire and Marine Insurance.

Calendar Year.	Stock and Mutual Companies.				
	Number of Companies.	Total Income	Payments to Policy Holders.		
			Losses.	Dividends.	Total.
1890	580	$157,857,983	$75,334,517	$5,433,495	$80,768,012
1895	555	176,300,042	89,673,663	7,705,363	97,379,026
1896	541	172,945,625	83,355,538	6,547,922	89,903,460
1897	530	176,751,124	79,440,595	7,724,657	87,165,252
1898	504	178,320,217	90,051,512	7,923,170	97,974,682
1899	484	184,142,217	106,726,658	7,892,714	114,619,372
1900	493	198,312,577	108,307,171	8,446,110	116,753,281
1901	482	216,452,381	112,008,998	9,011,926	121,020,924
1902	489	239,468,206	113,147,727	10,184,285	123,302,012
1903	526	258,340,036	112,817,357	11,559,470	124,376,827
1904	515	278,340,036	151,264,900	12,855,153	164,120,053
1905	575	293,224,649	125,074,600	14,379,174	139,453,774
1906	597	350,285,740	276,795,627	15,412,212	292,207,839
1907	618	338,232,409	145,597,362	16,223,261	161,820,623
1908	598	334,490,040	165,489,578	17,808,367	183,297,945
1909	598	360,545,341	154,430,781	19,091,596	173,522,377
1910	597	381,545,814	166,789,763	20,709,261	187,499,024
1911	593	388,462,193	183,476,741	18,771,959	202,248,700

Calendar Year.	Lloyd's and Interinsurance Associations.			Total.		
	Number of Associations.	Total Income.	Losses Paid.	Number of Companies.	Total Income.	Payments to Policy Holders.
1890	.....	.....	.....	580	$157,857,983	$80,768,012
1895	.....	.....	.....	583	176,300,042	97,379,026
1896	.....	.....	.....	541	172,945,625	89,903,460
1897	.....	.....	.....	530	176,751,124	87,165,252
1898	.....	.....	.....	504	178,320,217	97,974,682
1899	.....	.....	.....	484	184,142,217	114,619,372
1900	.....	.....	.....	493	198,312,577	116,753,281
1901	.....	.....	.....	482	216,452,381	121,020,924
1902	.....	.....	.....	489	239,468,206	123,332,012
1903	37	$2,972,800	$1,057,238	563	261,431,401	125,434,065
1904	35	2,888,366	1,538,505	550	281,228,402	165,658,558
1905	37	3,337,939	1,371,417	612	296,562,588	140,825,191
1906	35	3,637,254	1,441,353	632	353,922,994	293,649,192
1907	36	4,298,640	1,616,001	654	342,531,049	163,436,624
1908	38	4,579,875	1,865,181	636	339,068,915	185,163,126
1909	38	4,719,072	1,938,834	636	365,264,413	175,461,211
1910	31	4,111,214	1,644,002	628	385,657,028	189,143,026
1911	28	4,504,793	1,440,809	621	392,966,986	203,689,509

Cuba's exports of sugar cane and its products were valued in 1910 at $101,500,000—70.28 per cent. of the total export.

CORPORATIONS, JOINT-STOCK COMPANIES OR ASSOCIATIONS, AND INSURANCE COMPANIES: YEAR ENDED JUNE 30, 1911.

At the end of the fiscal year 1911 a report based on 31,188 financial and commercial companies and corporations, including banks, banking associations, trust companies, guaranty and surety companies, title insurance companies, building associations (if for profit), and insurance companies not specially exempt, showed that the amount of capital stock of these companies totaled $2,783,180,912.99; that the amount of bonded and other indebtedness was $549,928,546.23; and that the net income amounted to $440,528,501.28. For the same period the public service, such as railroads, steamboat, ferryboat and stage-line companies, pipe-line, gas, and electric-light companies, transportation and storage companies, telegraph and telephone companies, basing the figures on the 24,694 reports received, had a capital stock of $19,329,023,135.35; an indebtedness, bonded and otherwise of $17,383,237,766.43; and a net income of $843,855,442.89. The third class, industrial and manufacturing, such as mining, lumber, and coke companies; rolling mills; foundry and machine shops; sawmills; flour, woolen, cotton, and other mills; manufacturers of cars, automobiles, elevators, agricultural implements, and all articles manufactured wholly or in part from metal, wood, or other material; manufacturers or refiners of sugar, molasses, syrups, or other products; ice or refrigerating companies; slaughterhouse, tannery, packing, or canning companies, have a capital stock of $26,177,131,698.07; an indebtedness, bonded and otherwise amounting to $7,894,834,181.56; and a total income of $1,436,061,261.73. This report was based on the 89,114 returns received. The 58,233 reports received from the mercantile class, including all dealers (not otherwise classed as producers or manufacturers) in coal, lumber, grain, produce, and all goods, wares, and merchandise, show a capital stock of $3,361,390,780.38; an indebtedness, bonded and otherwise, of $2,009,749,482.83; and a net income of $385,304,595.65. The last or miscellaneous class, such as architects, contractors, hotels, the theaters, or other companies or associations, not otherwise classed, had a capital stock of $6,235,703,992.25; an indebtedness, bonded and otherwise amounting to $2,877,586,031.79; and a net income of $254,500,841.10. This report was based on 66,973 returns received.

Booklovers' Magazine

COMPARISON OF THE CHINESE EMPIRE WITH EASTERN UNITED STATES.

COMPARATIVE NON-PARTICIPATING PREMIUM RATES OF AMERICAN LIFE INSURANCE COMPANIES, 1860, 1870, 1880, 1890, 1900, 1910—WHOLE LIFE PLAN.*

AVERAGE PREMIUM RATES PER $1,000 INSURANCE.

Age.	1860.		1870.		1880.		1890.		1900.		1910.	
	Number of Companies.	Average Rate.	Number of Companies.	Average Rate.	Number of Companies.	Average Rate.	Number of Companies.	Average Rate.	Number of Companies.	Average Rate.	Number of Companies.	Average Rate.
20	6	$15.27	26	$13.57	..	.....	4	$14.61	5	$14.38	50	$15.23
21	6	15.68	28	13.88	.	.....	4	14.81	5	14.72	76	15.65
22	6	16.11	28	14.19	..	.....	4	15.07	5	15.08	76	16.00
23	6	16.58	28	14.49	..	.....	4	15.28	5	15.45	76	16.37
24	6	17.03	28	14.80	..	.....	4	15.62	5	15.85	76	16.75
25	6	17.55	29	15.20	4	$15.64	4	15.93	5	16.27	76	17.16
26	6	18.08	29	15.63	4	16.04	4	16.36	5	16.72	76	17.58
27	6	18.63	29	16.08	4	16.46	4	16.79	5	17.17	76	18.03
28	6	19.19	29	16.55	4	16.91	4	17.26	5	17.66	76	18.49
29	6	19.76	29	17.06	4	17.37	4	17.74	5	18.17	76	19.00
30	6	20.29	29	17.52	4	17.87	4	18.26	5	18.70	76	19.51
31	6	20.87	29	18.02	4	18.38	4	18.81	5	19.27	76	20.07
32	6	21.48	29	18.59	4	18.94	4	19.38	5	19.87	76	20.64
33	6	22.13	29	19.16	4	19.51	4	19.97	5	20.50	76	21.26
34	6	22.81	29	19.79	4	20.15	4	20.62	5	21.17	76	21.90
35	6	23.53	29	20.44	4	20.81	4	21.30	5	21.88	76	22.59
36	6	24.30	29	21.14	4	21.51	4	22.02	5	22.62	76	23.31
37	6	25.07	29	21.86	4	22.23	4	22.78	5	23.41	76	24.07
38	6	25.93	29	22.64	4	23.03	4	23.60	5	24.25	76	24.88
39	6	26.83	29	23.46	4	23.85	4	24.45	5	25.14	76	25.74
40	6	27.75	29	24.33	4	24.76	4	25.38	5	26.09	76	26.65
41	6	28.70	29	25.24	4	25.71	4	26.35	5	27.09	76	27.62
42	6	29.64	29	26.20	4	26.72	4	27.37	5	28.17	76	28.64
43	6	30.66	29	27.21	4	27.79	4	28.46	5	29.31	76	29.74
44	6	31.74	29	28.30	4	28.94	4	29.64	5	30.53	76	30.91
45	6	32.89	29	29.46	4	30.16	4	30.89	5	31.83	76	32.14
46	6	34.12	29	30.70	4	31.46	4	32.21	5	33.20	76	33.46
47	6	35.43	29	32.19	4	32.86	4	33.63	5	34.66	76	34.87
48	6	36.87	29	33.41	4	34.34	4	35.11	5	36.22	76	36.37
49	6	38.46	29	34.98	4	35.94	4	36.74	5	37.86	76	37.97
50	6	40.20	29	36.63	4	37.65	4	38.48	5	39.62	76	39.69
51	6	42.09	29	38.45	4	39.46	4	40.28	5	41.48	76	41.49
52	6	44.10	29	40.35	4	41.38	4	42.22	5	43.46	76	43.43
53	6	46.25	29	42.38	4	43.45	4	44.32	5	45.57	76	45.49
54	6	48.59	29	44.55	4	45.68	4	46.53	5	47.81	76	47.69
55	6	51.12	29	46.88	4	48.10	4	48.92	5	50.20	76	50.04
56	5	54.29	27	49.37	4	50.72	4	51.49	5	52.74	75	52.53
57	5	57.14	27	52.39	4	53.54	4	54.27	5	55.45	75	55.22
58	5	60.18	27	54.88	4	56.54	4	57.21	5	58.34	75	58.08
59	5	63.29	27	57.85	4	59.75	4	60.36	5	61.42	75	61.16
60	5	66.19	27	60.92	4	63.18	4	63.73	5	64.71	75	64.44

* The premium rates for 1860 and 1870 are compiled from the Reports of the New York Insurance Department of 1861 and 1869, respectively. The rates for 1880 and 1890 are compiled from the Spectator Year Books of 1881 and 1891, and the rates for 1900 and 1910 are from the Spectator Handy Guides for those years.

AREA OF THE LARGEST ISLANDS OF THE EARTH.

	Sq. Miles.		Sq. Miles.		Sq. Miles.		Sq. Miles.
Greenland	837,760	Great Britain	88,000	Luzon	40,930	Haiti	29,810
New Guinea	303,500	Hondo	87,490	Iceland	39,756	Sakhalin	29,114
Borneo	284,840	Celebes	71,470	Mindanao	37,180	Tasmania	26,215
Madagascar	228,600	Java	49,030	Yezo	36,300	Ceylon	25,330
Sumatra	161,610	Cuba	46,000	Novaya Zemlya	35,520	Kuishiu	16,840
New Zealand	104,400	Newfoundland	40,200	Ireland	32,530	Formosa	13,460

ORDINARY AND INDUSTRIAL INSURANCE IN FORCE BY STATES, DECEMBER 31, 1910.*

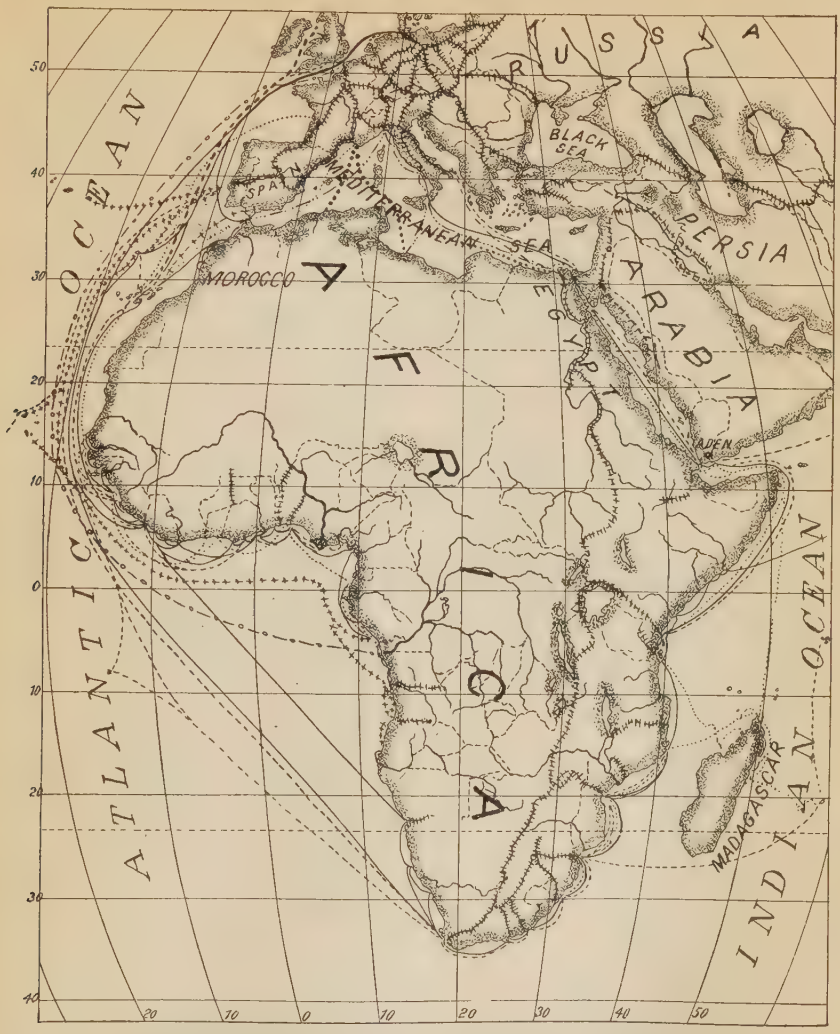
State.	Total Population 1910.	Ordinary Insurance in Force.	Industrial Insurance in Force.	Total Insurance in Force.	Insurance in Force per Capita.
Alabama	2,138,093	$160,000,997	$8,953,990	$168,954,987	$79
Arizona	204,354	17,706,369	.....	17,706,369	87
Arkansas	1,574,449	91,092,866	2,927,661	94,020,527	60
California	2,377,549	391,875,291	40,040,942	431,916,233	182
Colorado	799,024	131,533,563	8,216,272	139,749,835	175
Connecticut	1,114,756	168,463,959	84,541,832	253,005,791	227
Delaware	202,322	24,247,892	17,225,939	41,473,831	205
District of Columbia	331,069	79,258,009	33,152,206	112,410,215	340
Florida	752,619	79,091,347	.....	79,091,347	105
Georgia	2,609,121	282,704,932	24,019,716	306,724,648	118
Idaho	325,594	27,892,642	.....	27,892,642	86
Illinois	5,638,591	1,007,271,561	103,774,012	1,111,045,573	197
Indiana	2,700,876	321,111,088	95,803,745	416,914,833	154
Iowa	2,224,771	221,095,910	16,620,410	226,031,973	102
Kansas	1,690,949	146,186,246	19,962,756	166,149,002	98
Kentucky	2,289,905	223,247,521	63,297,260	286,544,781	125
Louisiana	1,656,388	149,288,555	29,971,837	179,260,392	108
Maine	742,371	97,241,628	16,509,020	113,750,648	153
Maryland	1,295,346	177,268,672	95,915,434	273,184,106	211
Massachusetts	3,366,416	635,619,342	257,300,837	892,920,179	265
Michigan	2,810,173	304,015,961	47,802,235	351,818,196	125
Minnesota	2,075,708	240,918,006	16,825,506	257,743,512	124
Mississippi	1,797,114	116,706,215	.....	116,706,215	65
Missouri	3,293,335	423,090,516	122,423,104	545,513,620	166
Montana	376,053	54,149,564	1,765,045	55,914,609	149
Nebraska	1,192,214	124,556,740	7,452,286	132,009,026	111
Nevada	81,875	11,983,559	.....	11,983,559	146
New Hampshire	430,572	53,151,854	14,359,926	67,511,780	157
New Jersey	2,537,167	394,358,783	278,891,717	673,250,500	265
New Mexico	327,301	22,159,552	.....	22,159,552	68
New York	9,113,614	1,859,488,827	705,260,714	2,564,749,541	281
North Carolina	2,206,287	156,137,868	9,079,925	165,217,793	75
North Dakota	577,056	55,203,241	.....	55,203,241	96
Ohio	4,767,121	691,213,034	197,072,487	888,285,521	186
Oregon	672,765	76,010,451	3,611,500	79,621,951	118
Pennsylvania	7,665,111	1,241,865,748	465,104,712	1,706,970,460	223
Rhode Island	542,610	85,064,017	52,623,684	137,687,701	254
South Carolina	1,515,400	114,622,829	15,116,654	129,739,483	86
South Dakota	583,888	63,579,694	.....	63,579,694	109
Tennessee	2,184,789	171,632,371	37,495,347	209,127,718	96
Texas	3,896,542	262,708,661	976,536	263,685,197	68
Utah	373,351	42,606,638	4,334,810	46,941,448	126
Vermont	355,956	57,606,582	7,044,595	64,651,177	182
Virginia	2,061,612	180,205,741	39,269,190	219,474,931	106
Washington	1,141,990	126,583,116	8,802,412	135,385,528	119
West Virginia	1,221,119	94,853,455	14,561,149	109,414,604	90
Wisconsin	2,333,860	224,237,069	35,588,883	259,825,952	111
Wyoming	145,965	16,871,048	.....	16,871,048	116

* Compiled from Spectator Year Book, 1911, p. 366.

F. L. Hoffman

HIGHEST MOUNTAINS IN THE WORLD.
(Exceeding 20,000 feet.)

Mountain.	Feet.	Mountain.	Feet.	Mountain.	Feet.	Mountain.	Feet.
Asia—Mt. Everest	29,002	Nanda Devi	25,600	Anconhuma	21,490	Tupungota	20,286
Godwin-Austen	28,278	Mustagata	24,400	Sorata	21,470	Cacaca	20,250
Kunchinginga	28,156	Chumalari	23,946	Illampu	21,490	Haina	20,171
Gusherbrum	26,378	South America—		Huandoy	21,089	San Jose	20,020
Dhawalagiri	26,826	Aconcagua	22,860	Sajama	21,047	Misti	20,013
Masherbrum	25,600	Mercedario	22,315	Illimani	21,030	North America—	
Kakapushi	25,560	Huascan	22,051	Paniri	20,735	McKinley	20,290
Kutha Kangir	24,740			Chimborazo	20,498		



PRINCIPAL STEAMSHIP ROUTES FROM AFRICA.

	Miles.
Length of the Equator	24,900
" " " Meridian	24,858
" " a Tropic	22,853
" " " Polar Circle	9,940
" " the Great Axis (diameter of the Equator)	7,926
" " " Little Axis (diameter through the Poles)	7,400
" " " Parallel Degree on the Equator	69.2
" " " " " in the Tropics	63.5
" " " " " in the Polar Circle	27.7
" " " " " at the Pole	0

The solid contents of the Globe amounts to 260,000,000,000 cubic miles.

CURRENCY OF EUROPEAN COUNTRIES.

COUNTRY. MONEY TABLE.	Standard Monetary Unit. and Approximate Value in U. S. Gold.	Bank Notes and Approximate Equivalent in U. S. Money.		Gold Coins and Approximate Equivalent in U. S. Money.		Sliver Coins and Approximate Equivalent in U. S. Money.		Copper and Nickel Coins and Approximate Equivalent in U. S. Money.	
		£	$	£	$	£	$	£	$
GREAT BRITAIN.		5	24.332			3d.	.06		
	Gold.	10	48.665			6d.	.1 1	Far-	
4 Farthings = 1 Penny.		20	97.33	Half Sov'gn	2.433	1s. Florin	.243	thing.	.005
		50	243.325	= 10s.		or 2s.	.486	Half Penny.	.01
12 Pence = 1 Shilling.	Pound Sterling: $4.866½	100	486.65			½ Crown			
		200	973.30	Sov'gn		or 2s. 6d.	.608		
		500	2433.25	= 20s.	4.866	4s.	.973	Penny.	.02
20 Shillings = £1.		1,000	4866.50			5s. or Crown	1.216		
		Francs.	$	Francs.	$		$	Sou or	
FRANCE.	Gold.	50	9.65			50c.	.096½	5c.	.0096½
		100	19.30	5	.97	1f.	.193		
100 Centimes = 1 Franc. (See Note, page 25.)	Franc: $0.193	500	96.50	10	1.93	2f.	.386	2 Sou or 10c.	.0193
		1,000	193.00	20	3.86	5f..	.965		
		Francs.	$	Francs.	$		$		$
BELGIUM.	Gold.	20	3.86			50c.	.096½	1c.	.0019
		50	9.65	10	1.93	1f.	.193	2c.	.0038
		100	19.30			2f.	.386	5c.	.0096
100 Centimes = 1 Franc.	Franc: $0.193	500	96.50	20	3.86	5f.	.965	10c.	.0193
		1,000	193.00					20c.	.0386
		Gulden.	$	Gulden.	$		$	copper.	$
		10	4.02						
NETHERLANDS. (HOLLAND.)	Gold.	25	10.05						
		40	16.08	5	2.01	5c.	.020		
		50	20.10			10c.	.040		
		60	24.12			25c.	.100	½c.	.002
		100	40.20	10	4.02	50c.	.201	1c.	.004
100 Cents = 1 Gulden.	Gulden: $0.402	200	80.40			1 Gul.	.402	2½c.	.010
		300	120.60			2½ Gul.	1.005		
		500	201.00						
		1,000	402.00						

CURRENCY OF EUROPEAN COUNTRIES.—*Continued.*

COUNTRY MONEY TABLE	Standard Monetary Unit, and Approximate Value in U. S. Gold.	Bank Notes and Approximate Equivalent in U. S. Money.		Gold Coins and Approximate Equivalent in U. S. Money		Silver Coins and Approximate Equivalent in U. S. Money.		Copper and Nickel Coins and Approximate Equivalent in U. S. Money.	
		Marks.	$	Marks.	$		$	copper.	$
						50 p. or		1p.	.002
GERMANY.	Gold.	5	1.19			½m.	.119	2p.	.005
		20	4.76	10	2.38	1m.	.238		
		50	11.90			2m.	.476	nickel.	
100 Pfennige = 1 Mark.	Mark: $0.238	100	23.80	20	4.76	3m.	.714	5	.012
		1,600	238.00			5m.	1.19	10	.024
		Kronen.	$		$		$	bronze.	$
AUSTRIA-HUNGARY.	Gold.	10	2.03	4fl.	1.62	1 kr. or		1h.	.002
		20	4.06	10kr. or		½fl.	.203	2h.	.004
		50	10.15	5 fl.	2.03	1fl.	.406		
100 Hellers = 1 Krone.	Krone: $0.203	100	20.30	8fl.	3.24	5kr.	1.015	nickel.	
		1,000	203.00	20kr. or				10h.	.020
				10fl.	4.06			20h.	.040
		Lire.	$	Lire.	$		$	copper.	$
ITALY.	Gold.	5	.965	5	.965	1 lira.	.193	5c.	.0096
		10	1.93					10c.	.0193
		50	9.65	10	1.93	2 lira.	.386	nickel.	
100 Centesimi = 1 Lira.	Lira: $0.193	100	19.30					20c.	.0386
		500	96.50	20	3.86	5 lira.	.965	25c.	.0482
		1,000	193.00						
		Kroner.	$	Kroner.	$	Ore.	$	bronze.	$
								Ore.	
NORWAY, SWEDEN AND DENMARK.	Gold.	1	0.268	5	1.34	10	.02		
		5	1.34	10	2.68	25	.06	1	.0025
		10	2.68	20	5.36	50	.12	2	.005
		50	13.40					5	.125
100 Ore = 1 Krone.	Krone: $0.268	100	26.80			Kroner.			
		500	134.00	Ducat.	2.24	1	.249		
		1,000	268.00			2	.499		

CURRENCY OF EUROPEAN COUNTRIES.—*Continued.*

COUNTRY. MONEY TABLE.	Standard Monetary Unit, and Approximate Value in U. S. Gold.	Bank Notes and Approximate Equivalent in U. S. Money		Gold Coins and Approximate Equivalent in U. S. Money.		Silver Coins and Approximate Equivalent in U. S. Money.		Copper and Nickel Coins and Approximate Equivalent in U. S. Money.	
		Rubles.	$	Rubles.	$	Kopecks.	$	copper. Kopecks	$
						5	.025		
		1	.515	5	2.57	10	.05		
RUSSIA.	Gold.	3	1.545	7½ or {	3.86	15	.076		
		5	2.575	½ Impl. {		20	.10	1	.0075
		10	5.15	10	5.15	25	.125	2	.015
		25	12.875	15 or {	7.72	50	.25	5	.0375
100 Kopecks = 1 Ruble.	Ruble: $0.515	50	25.75	1 Impl. {		100	.50		
		100	51.40			Ruble.			
		500	257.50			½	.25		
						1	.50		
		Peseta.	$	Doubl'n	$	Peseta.	$	bronze.	$
SPAIN.	Gold.			1-16	0.95				
				⅛	1.90				
				¼	3.83	1	.174		
		25	4.825	½	7.75	2	.348		
100 Centimos = 1 Peseta.	Peseta: $0.19	50	9.65	1	15.50	5	.87	Centimo.	
		100	19.30	Peseta.				1	.00175
		500	96.50	5	.965	Centimo	$	2	.0035
		1,000	193.00	10	1.93	50	.087	5	.00875
				20	3.86				
				25	4.825				

SWITZERLAND.—The monetary system of SWITZERLAND is the same as that of France, its coins bearing also the same names.

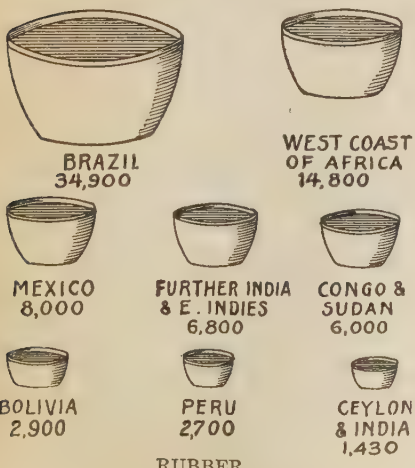
NOTE. FRANCE.—Belgian, Swiss, Austrian, Russian, Spanish, Italian and Servian gold pieces and Belgian, Swiss and Greek silver coins are current in France. Five Lire Italian pieces are also current, but not Italian silver of lower values.

Copper coins of foreign countries do not circulate in France.

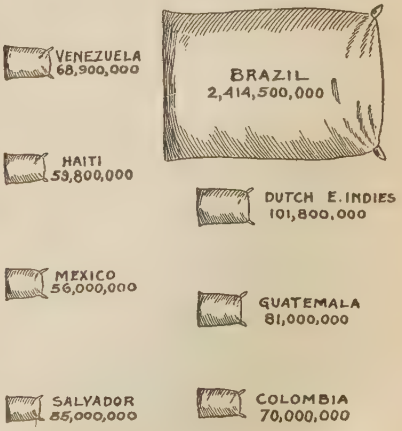
CAUTION.—Do not take any bad money.

The following coins which are uncurrent in France, and worth only their metal value, are frequently offered tourists in change by cabmen and others. Tourists will do well to examine silver change received and reject such coins, viz.: French silver coins below the value of 5 Fcs. minted prior to 1863, and Spanish, South American and Papal silver coins regardless of denomination.

PRINCIPAL STEAMSHIP ROUTES FROM ASIA.



RUBBER.
A YEAR'S PRODUCTION.
(in tons.)

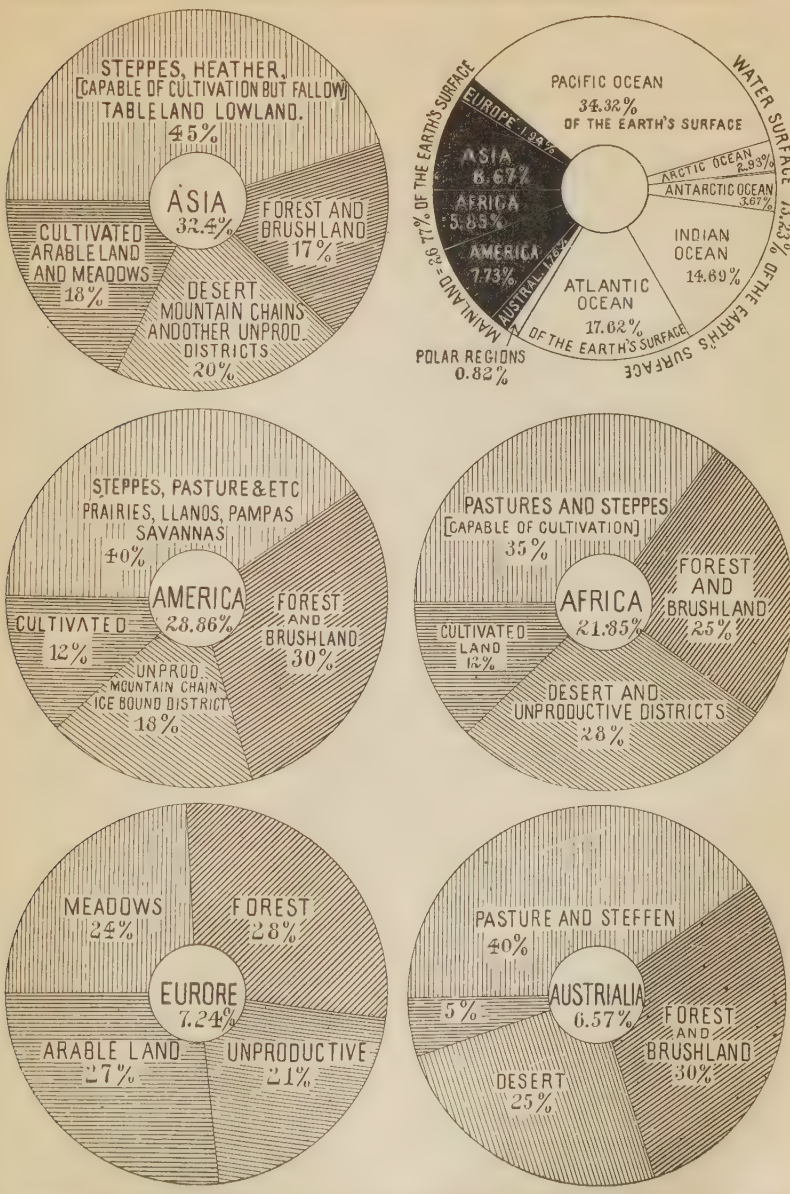


COFFEE.
ONE YEAR'S PRODUCTION.
(in lbs.)

VALUE OF FOREIGN COINS APRIL 1, 1911 AND 1912.

[Compiled from Circulars of the Director of the Mint.]

COUNTRY.	STANDARD.	MONETARY UNIT.	1911	1912
Argentina	Gold	Peso [1]	$0.965	$0.965
Austria-Hungary	do	Crown	.203	.203
Belgium	do / Silver [2]	Franc	.193	.193
Bolivia [3]	Gold	Boliviano	.389	.389
Brazil	do	Milreis	[4] .546	[4] .546
British colonies in Australasia and Africa.	do	Pound sterling	4.866½	4.866½
Canada	do	Dollar	1.000	1.000
British Honduras	do	do	1.000	1.000
Central American States:				
Costa Rica	do	Colon	.465	.465
Guatemala, Honduras, Nicaragua, Salvador	Silver	Peso	[5] .389	[5] .423
Chile	Gold	do	.365	[6] .365
China	Silver	Tael: Amoy	.638	.693
		Tael: Canton	.636	.691
		Tael: Chefoo	.610	.663
		Tael: Chin Kiang	.623	.677
		Tael: Fuchau	.590	.641
		Tael: Haikwan (customs)	.649	.706
		Tael: Hankau	.597	.649
		Tael: Kiaochou	.618	.672
		Tael: Nanking	.632	.686
		Tael: Newchwang	.598	.650
		Tael: Ningpo	.614	.667
		Tael: Peking	.622	.676
		Tael: Shanghai	.583	.633
		Tael: Swatow	.590	.641
		Tael: Takau	.642	.698
		Tael: Tientsin	.618	.672
		Dollar: Yuan	.....	.505
		Dollar: Hongkong	.420	.436
		Dollar: British	.420	.456
		Dollar: Mexican	.423	.459
Colombia	Gold	Dollar	[7] 1.000	[7] 1.000
Denmark	do	Crown	.268	.268
Ecuador	Gold	Sucre	$0.487	$0.487
Egypt	do	Pound (100 piasters) [8]	4.943	4.943
Finland	do	Mark	.193	.193
France	do / Silver [2]	Franc	.193	.193
German Empire	Gold	Mark	.238	.238
Great Britain	do	Pound sterling	4.866½	4.866½
Greece	do / Silver [2]	Drachma	.193	.193
Haiti	Gold	Gourde	[9] .965	[9] .965
India (British)	do	Rupee [10]	.324⅓	.324⅓
Italy	do / Silver [2]	Lira	.193	.193
Japan	Gold	Yen	.498	.498
Liberia	do	Dollar	[11] 1.000	[11] 1.000
Mexico	do	Peso	.498	.498
Netherlands	do	Florin	.402	.402
Newfoundland	do	Dollar	1.014	1.014
Norway	do	Crown	.268	.268
Panama	do	Balboa	1.000	1.000
Persia	do / Silver	Kran	[12] .1704	[12] .1704
Peru	Gold	Libra	4.866½	4.866½
Philippine Islands	do	Peso	.500	.500
Portugal	do	Milreis	[13] 1.080	[13] 1.080
Roumania	do	Leu	.193	.193
Russia	do	Ruble	.515	.515
Santo Domingo	do	Dollar	1.000	1.000
Servia	do	Dinar	.193	.193
Siam	do	Tical	.3708	.3708
Spain	do / Silver [2]	Peseta	[14] .193	[14] .193
Straits Settlements	Gold	Dollar	.421	.5677
Sweden	do	Crown	.268	.268
Switzerland	do / Silver [2]	Franc	.193	.193
Turkey	Gold	Piaster	.044	.044
Uruguay	do	Peso	1.034	1.034
Venezuela	do	Bolivar	.193	.193



DISTRIBUTION OF LAND AND WATER ON THE EARTH'S SURFACE AND THE DIVISION OF LAND IN FIVE CONTINENTS.

Customs and Internal Revenue Collected on Distilled Spirits, Wines, Malt Liquors and Tobacco with Total National Revenue and Percentage: 1911.

For the year 1911 the total national ordinary receipts from all sources amounted to $701,372,375 and the total internal revenue and customs receipts from alcoholic beverages and tobacco and the manufacture of same amounted to $329,381,000, or in other words the receipts from alcoholic beverages and tobacco was 46.96 per cent. of the total revenue of the United States.

The customs revenue from alcoholic beverages, amounting to $16,663,000, was divided as follows: From malt liquors $2,075,000, from wine $5,495,000, from distilled spirits $9,093,000. The customs revenue from tobacco and the manufacture of same amounted to $26,160,000. The internal revenue from alcoholic beverages, exclusive of licensed duties, which for the manufacture of malt liquors and distilled spirits amounted to $503,000 and for the sale of malt liquors and distilled spirits to $7,340,000, totaling $211,805,000, was divided as follows: From malt liquors $63,217,000 and from distilled spirits $148,588,000. The internal revenue from tobacco amounted to $66,910,000. Thus for the year 1911 the total internal revenue and customs receipts from alcoholic beverages amounted to $236,311,000 and from tobacco and the manufacture of same to $93,070,000.

Domestic Express Rates.

It is impossible in the space allotted to the subject to give an accurate idea of domestic express rates. However, the matter will be greatly simplified if the rates based on a zone system, as advocated by the Interstate Commerce Commission, are put into effect. In any case, the introduction of the Parcels Post will cause a material reduction in the present rates and tariffs.

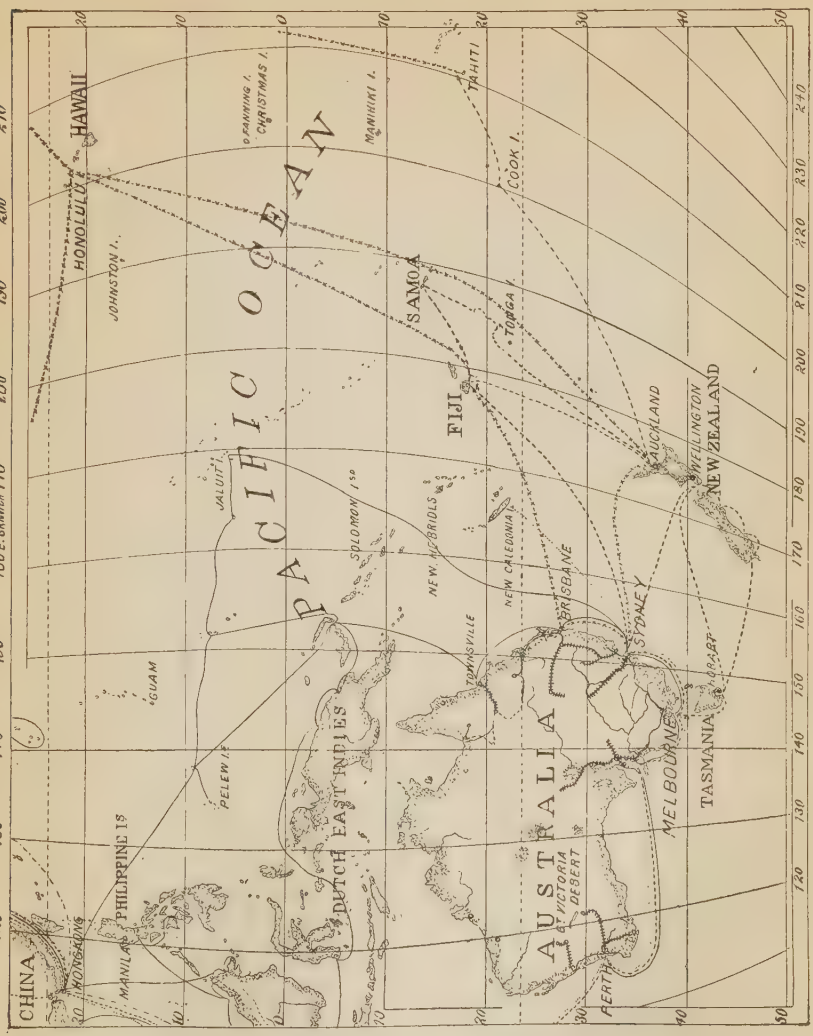
Foreign Express Rates.

The following is a tariff of all rates for express packages. It should be remembered that rates of this kind are subject to change without notice, and they are published solely in the interests of the shipper. These rates may be considered to be maximum. Thus we find another company offering shippings to Italy as low as 40 cents a single pound to Genoa, 60 cents to Rome, and 65 cents to other railway stations. Also a rate of 30 cents a pound to Paris and 25 cents a pound for shipments to London, via Southampton. The rates on say a hundred pounds do not vary in quite the same ratio. It is believed that with this tariff of rates the intending traveler can make his arrangements as to shipping packages of guide books, etc., rather more intelligently than without it. Rates to South Africa, North Africa, Asia, India, Japan, Australia, the West Indies, Porto Rico, Central America and South America are not included, as these rates vary so radically that it is impossible to get any accurate idea of what the shipment would actually cost without the publication of a more extensive table than space will permit.

OCEAN EXPRESS TARIFF FOR SMALL SHIPMENTS

EXPRESS RATES FROM NEW YORK OR BOSTON TO THE FOLLOWING PLACES:	lb. 1	lbs. 2	lbs. 4	lbs. 6	lbs. 8	lbs. 10	lbs. 20	lbs. 30	lbs. 40	lbs. 50	lbs. 60	lbs. 70	lbs. 80	lbs. 90	lbs. 100	Each Additional 20 pounds.	Value Rate per $100.	Insurance Rate per $100.
Liverpool, Havre, Hamburg, Bremen, Antwerp, Rotterdam, and London via Southampton	.30	.35	.45	.55	.65	.75	.90	1.20	1.50	1.70	1.90	2.10	2.30	2.40	2.50	.30	.40	.30
London, via Liverpool	.35	.40	.50	.60	.70	.80	1.20	1.80	2.20	2.50	2.70	2.90	3.10	3.30	3.50	.40	.50	.35
Paris, Berlin and Genoa	.35	.40	.50	.70	.90	1.00	1.40	1.90	2.40	2.80	3.00	3.20	3.40	3.70	4.00	.45	.50	.35
England, Ireland, Scotland, and Wales	.40	.45	.55	.65	.75	.90	1.20	1.80	2.20	2.50	2.70	2.90	3.10	3.40	3.60	.45	.50	.40
France and Germany*	.50	.60	.80	1.00	1.20	1.40	2.00	2.50	3.00	3.30	3.60	3.80	4.00	4.30	4.50	.50	.50	.40
Holland and Belgium*	.40	.45	.55	.65	.75	.90	1.30	1.80	2.10	2.40	2.60	2.80	3.10	3.20	3.40	.40	.50	.50
Norway and Denmark*	.45	.50	.70	.90	1.10	1.30	1.90	2.50	2.60	3.00	3.20	3.40	3.70	3.90	4.20	.45	.75	.40
Sweden*	.45	.50	.70	.90	1.30	1.60	2.50	3.20	3.50	3.60	4.00	4.20	4.50	4.70	4.90	.50	.75	.60
Austria, Hungary and Switzerland*	.60	.70	1.00	1.20	1.40	1.60	1.90	2.20	2.80	3.20	3.50	4.00	4.50	5.00	5.20	.50	.75	.55
Russia, Turkey and Greece*	1.50	1.90	2.40	2.60	2.80	3.00	3.80	4.20	4.80	5.20	5.60	6.00	6.20	6.40	6.50	.65	1.75	.90
Italy, Spain, Portugal, Gibraltar, Malta*	.70	.75	.90	1.10	1.30	1.50	2.70	3.30	3.80	4.20	4.60	4.80	5.00	5.20	5.40	.55	1.25	.70

The above rates are figured to cover a thoroughly first class express service. *All towns where there is a R. R. Station.



PRINCIPAL STEAMSHIP ROUTES FROM AUSTRALASIA.

INTERNATIONAL UNION FOR THE PUBLICATION OF CUSTOMS TARIFFS.

The International Union for the Publication of Customs Tariffs was founded by an international convention, July 5, 1890, and concluded between fifty-two states and semi-independent colonies. The object of the union is to publish as promptly and as correctly as possible all the tariffs of the world in five languages, viz., English, French, German, Italian, and Spanish. The bureau has its seat at Brussels, and is under the direct control of the Government of Belgium. The members of the bureau are delegates from the principal countries whose language is used in the publications.

Monetary Systems and Approximate Stocks of Money, in the Aggregate

	Countries.	Monetary standard.	Monetary unit.	Population.	Stock of gold.		
					In banks and public treasuries.	In circulation.	Total.
				Thousands.	*Thousands.*	*Thousands.*	*Thousands.*
1	United States	Gold	Dollar	93,200	$1,331,300	$378,700	$1,710,000
2	Austria Hungary	do	Crown	50,500	271,600	85,500	357,100
3	Belgium	do	Franc	7,300	24,300		
4	British Empire:						
5	Australia	do	Pound sterling	4,300	184,500	14,600	199,100
6	Canada	do	Dollar	6,200	108,200		108,200
7	United Kingdom	do	Pound sterling	45,000	314,200	335,800	[1] 650,000
8	India	do	Pound sterling and rupee.	295,000	13,200		13,200
9	South Africa	do	Pound sterling	7,800	50,400	15,000	65,400
10	Straits Settlements.[2]	do	Dollar	1,600	2,200		2,200
11	Bulgaria	do	Lev	4,000	6,100		6,100
12	Cuba	do	Peseta	2,100			42,000
13	Denmark	do	Crown	2,700	19,700	18,200	37,900
14	Egypt	do	Piaster	11,300	8,300	174,600	[4] 182,900
15	Finland	do	Markkaa	2,900	4,200	2,900	7,100
16	France	do	Franc	39,300	632,900	525,100	[7] 1,158,000
17	Germany	do	Mark	63,600	185,900		
18	Greece	do	Drachma	2,600	19,700	1,900	21,600
19	Haiti	do	Gourde	1,500	1,300		
20	Italy	do	Lira	33,900	264,100		
21	Japan	do	Yen	52,900	110,800	15,500	126,300
22	Mexico	do	Peso	13,600	28,600		28,600
23	Netherlands	do	Florin	5,800	50,200	19,200	69,400
24	Norway	do	Crown	2,300	9,200	4,600	13,800
25	Portugal	do	Milreis	5,400	8,600		8,600
26	Roumania	do	Lei	6,800	19,700		
27	Russia	do	Rouble	154,000	634,100	327,300	961,400
28	Servia	do	Dinar	2,800	5,100		
29	Siam	do	Tical	7,000	100		
30	South American States:						
31	Argentine	do	Peso	7,000	244,400		244,400
32	Bolivia	do	Boliviano	2,300	2,500		2,500
33	Brazil	do	Milreis	20,500	98,500		98,500
34	Chile	do	Peso	3,500	500		500
35	Colombia	do	Dollar	4,300			
36	Ecuador	do	Sucre	1,500	2,400	2,100	4,500
37	Guiana:						
38	British	do	Pound sterling	300	100		100
39	Dutch	do	Florin	100	100		100
40	French	do	Franc	100	100		100
41	Paraguay	do	Peso	800	300		300
42	Peru	do	Sol	4,500	8,300	3,900	12,200
43	Uruguay	do	Peso	1,100	15,500		15,500
44	Venezuela	do	Bolivar	2,600	400	2,900	3,300
45	Spain	do	Peseta	19,700	106,800		106,800
46	Sweden	do	Crown	5,400	21,600	3,200	24,800
47	Switzerland	do	Franc	3,300	30,000	34,700	64,700
48	Turkey	do	Piaster	24,000	15,500	136,400	151,900
49	Central American States.	Silver[3]	Peso	5,300	1,500	100	1,600
	Total			1,031,700	4,857,000	2,102,200	6,500,700

[1] Estimates for the United Kingdom prior to that for 1910 were for coin only; these figures include $100,000,000 for bullion in the Bank of England.
[2] Includes Straits Settlements, the Malay States, and Johore.
[3] Except Costa Rica and British Honduras (gold standard countries).
[4] This estimate is based upon a calculation made by Messrs. P. Arminjon and B. Michel in 1908, who estimated the stock of gold in the country at from 33,000,000 to 41,000,000 Egyptian pounds. The mean of these figures was adopted in this table last year. Since their estimate was made the net imports of gold into Egypt to Dec. 31, 1910, have amounted to $28,919,061, but as there is said to be a considerable absorption of gold for ornaments, no change in the estimate of the monetary stock has been made.
[5] This amount has been reduced to a gold basis; that is, 100 pesos equal 1 United States gold dollar.
[6] Gold conversion value.
[7] Estimate of A. De Foville, 1909.
[8] This is the amount in the currency reserves. Fred. J. Atkinson, accountant-general of India, in 1908, estimated the active rupee circulation at 2,040,000,000 rupees; small silver coin at 140,000,000 rupees.

NOTE.—The blank spaces in this table signify that no satisfactory information is available.

AND PER CAPITA, IN THE PRINCIPAL COUNTRIES OF THE WORLD, DECEMBER 31, 1910.

Stock of silver.			Uncovered paper.	Per capita.				
Full tender.	Limited tender.	Total.		Gold.	Silver.	Paper.	Total.	
Thousands.	*Thousands.*	*Thousands.*	*Thousands.*					
$568,300	$161,200	$729,500	$784,600	$18.35	$7.83	$8.41	$34.59	1
Nil.	129,100	129,100	143,500	7.07	2.56	2.84	12.47	2
12,400	2,600	15,000	135,300	3.33	2.05	18.53	23.91	3
								4
Nil.	10,000	10,000	.....	46.30	2.33	.....	48.63	5
Nil.	6,700	6,700	76,800	17.45	1.08	12.39	30.92	6
Nil.	116,800	116,800	115,200	14.44	2.60	2.56	19.60	7
101,000	45,000	146,000	38,900	.05	.49	.13	.67	8
Nil.	20,000	20,000	.....	8.38	2.56	.....	10.94	9
Nil.	37,500	37,500	7,500	1.37	23.44	4.69	29.50	10
.....	4,800	4,800	9,800	1.53	1.20	2.45	5.18	11
Nil.	5,000	5,000	.....	20.00	2.38	.....	22.38	12
Nil.	8,000	8,000	13,500	14.04	2.96	5.00	22.00	13
Nil.	15,800	15,800	6,700	16.19	1.40	.59	18.18	14
Nil.	500	500	11,500	2.45	.17	3.96	6.58	15
347,400	63,700	411,100	223,000	29.46	10.47	5.67	45.60	16
Nil.	243,900	243,900	276,100	2.93	3.83	4.34	11.10	17
.....	3,000	3,000	24,600	8.31	1.15	9.46	18.92	18
1,000	1,500	2,500	8,200	.87	1.67	5.46	8.00	19
22,700	1,400	24,100	182,300	7.79	.71	5.38	13.88	20
Nil.	125,100	125,100	89,300	1.36	2.36	1.69	5.41	21
52,000	4,000	56,000	51,200	2.10	4.12	3.76	9.98	22
.....	33,300	33,300	60,300	11.97	5.74	10.39	28.10	23
Nil.	3,400	3,400	5,400	6.00	1.48	2.35	9.83	24
Nil.	37,200	37,200	72,600	1.59	6.89	13.44	21.92	25
.....	200	200	38,100	2.90	.03	5.60	8.53	26
Nil.	78,500	78,500	.....	6.24	.51	.....	6.75	27
.....	1,500	1,500	5,300	1.82	.54	1.89	4.25	28
49,400	.....	49,400	2,100	.01	7.06	.30	7.37	29
								30
Nil.	9,400	9,400	[6] 315,000	36.21	1.34	45.00	82.55	31
Nil.	500	500	4,000	1.09	.22	1.73	3.04	32
Nil.	25,000	25,000	[6] 200,700	4.80	1.22	9.79	15.81	33
Nil.	2,800	2,800	53,400	.14	.80	15.26	16.20	34
Nil.	.....	.....	[5] 10,000	.....	.....	2.33	2.33	35
Nil.	1,300	1,300	2,000	3.00	.87	1.33	5.20	36
								37
Nil.	400	400	500	.33	1.33	1.67	3.33	38
Nil.	300	300	200	1.00	3.00	2.00	6.00	39
Nil.	100	100	600	1.00	1.00	6.00	8.00	40
Nil.	.....	.....	33,000	.38	.....	41.25	41.63	41
Nil.	2,400	2,400	.....	2.71	.53	.....	3.24	42
Nil.	4,300	4,300	1,700	14.09	3.91	1.55	19.55	43
Nil.	11,500	11,500	4,300	1.27	4.42	1.65	7.34	44
.....	173,700	173,700	76,000	5.42	8.82	3.85	18.09	45
Nil.	8,600	8,600	32,400	4.59	1.59	6.00	12.18	46
.....	13,500	13,500	25,400	19.60	4.09	7.70	31.39	47
Nil.	26,400	26,400	.....	6.33	1.10	.....	7.43	48
Nil.	5,400	5,400	14,500	.30	1.01	2.74	4.05	49
1,154,200	1,445,300	2,599,500	3,155,500	.....	.....	.....	.....	

Report of the Director of the Mint.

INTEREST TABLES.

SIMPLE INTEREST.*

Time.	1 day.	2 days.	3 days.	4 days.	5 days.	6 days.	7 days.	8 days.	9 days.	10 days.	20 days.	1 mo.	2 mos.	3 mos.	4 mos.	5 mos.	6 mos.	1 year.
Amt. Int.																		
$1..... 4	....	....	....	....	....	....	....	....	....	....	....	.....	.....	1	1	1	2	4
5	....	....	....	....	....	....	....	....	....	....	....	....	1	1	2	2	3	5
6	....	....	....	....	....	....	....	....	....	....	....	1	1	1	2	3	3	6
7	....	....	....	....	....	....	....	....	....	....	....	1	1	1	2	3	4	7
$2..... 4	....	....	....	....	....	....	....	....	....	....	1	1	1	2	2	3	4	8
5	....	....	....	....	....	....	....	....	....	....	1	1	2	3	3	4	5	10
6	....	....	....	....	....	....	....	....	....	....	1	1	2	3	4	5	6	12
7	....	....	....	....	....	....	....	....	....	....	1	1	2	4	5	6	7	14
$3..... 4	....	....	....	....	....	....	....	....	....	....	....	1	2	3	4	5	6	12
5	....	....	....	....	....	....	....	....	....	....	1	1	3	4	5	6	8	15
6	....	....	....	....	....	....	....	....	....	1	1	2	3	5	6	8	9	18
7	....	....	....	....	....	....	....	....	....	1	1	2	4	5	7	9	11	21
$4..... 4	....	....	....	....	....	....	....	....	....	1	1	1	2	4	5	6	8	16
5	....	....	....	....	....	....	....	....	....	1	1	2	3	5	7	8	10	20
6	....	....	....	....	....	....	....	....	....	1	1	2	4	6	8	10	12	24
7	....	....	....	....	....	....	....	....	....	1	2	2	5	7	9	12	14	28
$5..... 4	....	....	....	....	....	....	....	....	....	1	1	1	3	5	6	8	10	20
5	....	....	....	....	....	....	....	....	....	1	1	2	4	6	8	10	13	25
6	....	....	....	....	....	....	....	....	....	1	2	3	5	8	10	13	15	30
7	....	....	....	....	....	....	....	....	....	1	2	3	6	9	12	15	18	35
$10.... 4	....	....	....	....	....	....	....	....	....	1	2	3	6	10	13	16	20	40
5	....	....	....	....	....	....	....	....	....	1	2	4	8	13	17	21	25	50
6	....	....	....	....	....	....	....	....	....	1	2	5	10	15	20	25	30	60
7	....	....	....	....	....	....	....	....	....	1	2	6	12	18	23	29	35	70
$25.... 4	....	....	....	....	....	....	....	....	....	2	3	6	12	18	24	30	36	72
5	....	....	....	....	....	....	....	....	....	2	4	8	16	25	33	41	50	1.00
6	....	....	....	....	....	....	....	....	....	3	5	10	20	30	40	50	60	1.20
7	....	....	....	....	....	....	....	....	....	3	6	12	23	35	46	58	70	1.40
$50.... 4	....	....	....	....	....	....	....	....	....	3	6	12	24	36	48	60	72	1.44
5	....	....	....	....	....	....	....	....	....	4	8	16	33	50	67	83	1.00	2.00
6	....	....	....	....	....	....	....	....	....	5	10	20	40	60	80	1.00	1.20	2.40
7	....	....	....	....	....	....	....	....	....	6	11	23	46	70	93	1.16	1.40	2.80
$100.... 4	....	....	....	....	....	....	....	....	....	6	13	26	53	80	1.06	1.33	1.60	3.20
5	....	....	....	....	....	....	....	....	....	8	16	33	66	1.00	1.33	1.67	2.00	4.00
6	....	....	....	....	....	....	....	....	....	10	20	40	80	1.20	1.60	2.00	2.40	4.80
7	....	....	....	....	....	....	....	....	....	11	23	46	93	1.40	1.86	2.33	2.80	5.60
$200.... 4	....	....	....	....	....	....	....	....	....	11	26	53	106	1.60	2.13	2.66	3.20	6.40
5	....	....	....	....	....	....	....	....	....	13	33	66	133	2.00	2.66	3.33	4.00	8.00
6	....	....	....	....	....	....	....	....	....	16	40	80	1.60	2.40	3.20	4.00	4.80	9.60
7	....	....	....	....	....	....	....	....	....	18	46	93	1.86	2.80	3.73	4.66	5.60	11.20
$300.... 4	....	....	....	....	....	....	....	....	....	16	40	80	1.60	2.40	3.20	4.00	4.80	9.60
5	....	....	....	....	....	....	....	....	....	20	50	100	2.00	3.00	4.00	5.00	6.00	12.00
6	....	....	....	....	....	....	....	....	....	24	60	120	2.40	3.60	4.80	6.00	7.20	14.40
7	....	....	....	....	....	....	....	....	....	28	70	140	2.80	4.20	5.60	7.00	8.40	16.80
$500.... 4	....	....	....	....	....	....	....	....	....	26	66	133	2.66	4.00	5.33	6.66	8.00	16.00
5	....	....	....	....	....	....	....	....	....	33	83	166	3.33	5.00	6.66	8.33	10.00	20.00
6	....	....	....	....	....	....	....	....	....	40	100	200	4.00	6.00	8.00	10.00	12.00	24.00
7	....	....	....	....	....	....	....	....	....	46	116	233	4.66	7.00	9.33	11.66	14.00	28.00
$1,000. 4	11	22	33	44	55	66	78	89	1.00	1.11	2.22	3.33	6.66	10.00	13.33	16.66	20.00	40.00
5	14	28	42	56	69	83	97	1.11	1.25	1.39	2.78	4.17	8.33	12.50	16.67	20.83	25.00	50.00
6	17	33	50	67	83	1.00	1.17	1.33	1.50	1.67	3.33	5.00	10.00	15.00	20.00	25.00	30.00	60.00
7	19	39	58	78	97	1.17	1.36	1.56	1.75	1.94	3.89	5.83	11.67	17.50	23.33	29.17	35.00	70.00

*In order to find the amount of interest at 1 1-2, 2 1-2, 3 1-2 per cent, etc., divide the amount given at twice the interest (i. e., 3, 5, 7 per cent, etc.) by 2.

COMPOUND INTEREST TABLE NO. 1.

SHOWING THE RATE AT WHICH $1 WILL INCREASE WHEN AT COMPOUND INTEREST.

Years.	3%	4%	5%	6%	7%	Years.	3%	4%	5%	6%	7%
1	1.0300	1.0400	1.0500	1.0600	1.0700	11	1.3842	1.5394	1.7103	1.8983	2.1048
2	1.0609	1.0816	1.1025	1.1236	1.1449	12	1.4258	1.6010	1.7959	2.0122	2.2522
3	1.0927	1.1249	1.1576	1.1910	1.2250	13	1.4685	1.6650	1.8856	2.1329	2.4098
4	1.1255	1.1699	1.2155	1.2624	1.3108	14	1.5126	1.7316	1.9799	2.2609	2.5783
5	1.1592	1.2166	1.2763	1.3382	1.4025	15	1.5580	1.8009	2.0789	2.3966	2.7590
6	1.1940	1.2653	1.3401	1.4185	1.5007	16	1.6047	1.8730	2.1828	2.5403	2.9522
7	1.2299	1.3159	1.4071	1.5036	1.6058	17	1.6528	1.9480	2.2928	2.6928	3.1588
8	1.2668	1.3686	1.4774	1.5938	1.7182	18	1.7034	2.0258	2.4060	2.8513	3.3790
9	1.3048	1.4233	1.5513	1.6984	1.8384	19	1.7535	2.1068	2.5269	3.0256	3.6165
10	1.3439	1.4802	1.6289	1.7908	1.9671	20	1.8061	2.1911	2.6533	3.2071	3.8697

COMPOUND INTEREST TABLE NO. 2

SHOWING THE INCREASE OF $1 IF INVESTED AT COMPOUND INTEREST FOR 100 YEARS.

Investment.	Per Cent.	Amt. in 100 yrs.	Investment.	Per Cent.	Amount in 100 years.	Investment.	Per Cent.	Amt. in 100 yrs.	Investment.	Per Cent.	Amount in 100 years.
$1.....	1	$2.75	$1.....	5	$131.25	$1	9	$5,513.00	$1	15	$1,174,405.00
1.....	2	7.25	1.....	6	340.00	1	10	13,809.00	1	18	15,145,000.00
1.....	3	19.25	1.....	7	868.00	1	12	84,675.00	1	24	2,551,799,404.00
1.....	4	50.50	1.....	8	2,203.00						

YEARS IN WHICH MONEY WILL DOUBLE AT SEVERAL RATES OF INTEREST.

Rate of Int.	Simple Interest.	Compound Interest.
1 %	100 years	69 years and 245 days
2 %	50 years	35 years
2½ %	40 years	28 years and 26 days
3 %	33 years and 4 months	23 years and 164 days
3½ %	28 years and 208 days.	20 years and 54 days
4 %	25 years	17 years and 246 days
4½ %	22 years and 81 days.	15 years and 273 days
5 %	20 years	14 years and 75 days.
6 %	16 years and 243 days.	11 years and 327 days.
7 %	14 years and 104 days.	10 years and 89 days.
8 %	12 years and 183 days.	9 years and 2 days.
9 %	11 years and 40 days.	8 years and 16 days.
10 %	10 years	7 years and 100 days.

TAALES OF WAGE.

MONTHLY WAGE TABLE.

Days	$10	$11	$12	$13	$14	$15	$16	$17	$18	$19	$20
1	.38	.42	.46	.50	.54	.58	.62	.65	.69	.73	.77
2	.77	.85	.92	1.00	1.08	1.15	1.23	1.31	1.38	1.46	1.54
3	1.15	1.27	1.38	1.50	1.62	1.73	1.85	1.96	2.08	2.19	2.31
4	1.54	1.69	1.85	2.00	2.15	2.31	2.46	2.62	2.77	2.92	3.08
5	1.92	2.12	2.31	2.50	2.69	2.88	3.08	3.27	3.46	3.65	3.85
6	2.31	2.54	2.77	3.00	3.23	3.46	3.69	3.92	4.15	4.38	4.62
7	2.69	2.96	3.23	3.50	3.77	4.04	4.31	4.58	4.85	5.12	5.38
8	3.08	3.38	3.69	4.00	4.31	4.62	4.92	5.23	5.54	5.85	6.15
9	3.46	3.81	4.15	4.50	4.85	5.19	5.54	5.88	6.23	6.58	6.92
10	3.85	4.23	4.62	5.00	5.38	5.77	6.15	6.54	6.92	7.31	7.69
11	4.23	4.65	5.08	5.50	5.92	6.35	6.77	7.19	7.62	8.04	8.46
12	4.62	5.08	5.44	6.00	6.46	6.92	7.38	7.85	8.31	8.77	9.23
13	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00	9.50	10.00
14	5.38	5.92	6.46	7.00	7.54	8.08	8.62	9.15	9.69	10.23	10.77
15	5.77	6.35	6.92	7.50	8.08	8.65	9.23	9.81	10.38	10.96	11.54
16	6.15	6.77	7.38	8.00	8.62	9.23	9.85	10.46	11.08	11.69	12.31
17	6.54	7.19	7.85	8.50	9.15	9.81	10.46	11.12	11.77	12.42	13.08
18	6.92	7.62	8.31	9.00	9.69	10.38	11.08	11.77	12.46	13.15	13.85
19	7.31	8.04	8.77	9.50	10.23	10.96	11.69	12.42	13.15	13.88	14.62
20	7.69	8.46	9.23	10.00	10.77	11.54	12.31	13.03	13.85	14.62	15.38
21	8.08	8.88	9.69	10.50	11.31	12.12	12.92	13.73	14.54	15.35	16.15
22	8.46	9.31	10.15	11.00	11.85	12.69	13.54	14.38	15.23	16.08	16.94
23	8.85	9.73	10.62	11.50	12.38	13.27	14.15	15.04	15.92	16.81	17.69
24	9.23	10.15	11.08	12.00	12.92	13.85	14.77	15.69	16.62	17.54	18.46
25	9.62	10.58	11.54	12.50	13.46	14.42	15.38	16.35	17.31	18.27	19.23
1 month	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00
2	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00
3	30.00	33.00	36.00	39.00	42.00	45.00	48.00	51.00	54.00	57.00	60.00
4	40.00	44.00	48.00	52.00	56.00	60.00	64.00	68.00	72.00	76.00	80.00
5	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00
6	60.00	66.00	72.00	78.00	84.00	90.00	96.00	102.00	108.00	114.00	120.00
7	70.00	77.00	84.00	91.00	98.00	105.00	112.00	119.00	126.00	133.00	140.00
8	80.00	88.00	96.00	104.00	112.00	120.00	128.00	136.00	144.00	152.00	160.00
9	90.00	99.00	108.00	117.00	126.00	135.00	144.00	153.00	162.00	171.00	180.00
10	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00
11	110.00	121.00	132.00	143.00	154.00	165.00	176.00	187.00	198.00	209.00	220.00
1 year	120.00	132.00	144.00	156.00	168.00	180.00	192.00	204.00	216.00	228.00	240.00

YEARLY WAGE TABLE.

Per Year.	Per Month.	Per Week.	Per Day.	Per Year.	Per Month.	Per Week.	Per Day.	Per Year.	Per Month.	Per Week.	Per Day.
$20 is	$1.67	$0.38	$0.05	$100 is	$8.33	$1.92	$0.27	$180 is	$15.00	$3.45	$0.49
25	2.08	.48	.07	105	8.75	2.01	.29	185	15.42	3.55	.51
30	2.50	.58	.08	110	9.17	2.11	.30	190	15.83	3.64	.52
35	2.92	.67	.10	115	9.58	2.21	.32	195	16.25	3.74	.53
40	3.33	.77	.11	120	10.00	2.30	.33	200	16.57	3.84	.55
45	3.75	.86	.12	125	10.42	2.40	.34	205	17.08	3.93	.56
50	4.17	.96	.14	130	10.83	2.49	.36	210	17.50	4.03	.58
55	4.58	1.06	.15	135	11.25	2.59	.37	215	17.92	4.12	.59
60	5.00	1.15	.16	140	11.67	2.69	.38	220	18.33	4.22	.60
65	5.42	1.25	.18	145	12.08	2.78	.40	225	18.75	4.31	.62
70	5.83	1.34	.19	150	12.50	2.88	.41	230	19.17	4.41	.63
75	6.25	1.44	.21	155	12.92	2.97	.42	235	19.58	4.51	.64
80	6.67	1.53	.22	160	13.33	3.07	.44	240	20.00	4.60	.66
85	7.08	1.63	.23	165	13.75	3.16	.45	245	20.42	4.70	.67
90	7.50	1.73	.25	170	14.17	3.26	.47	250	20.83	4.79	.69
95	7.92	1.82	.26	175	14.58	3.36	.48				

WEEKLY WAGE TABLE.

Hours.	$1.00	$2.00	$3.00	$4.00	$5.00	$6.00	$7.00	$8.00	$9.00	$10.00	$11.00	$12.00	$13.00	$14.00
½	.01	.01⅔	.02½	.03½	.04½	.05	.06	.06⅔	.07½	.08⅓	.09	.10	.11	.12
1	.01⅔	.03⅓	.05	.06⅔	.08⅓	.10	.11⅔	.13⅓	.15	.16⅔	.18⅓	.20	.22	.23⅓
2	.03⅓	.06⅔	.10	.13⅓	.16⅔	.20	.23⅓	.26⅔	.30	.33⅓	.36⅔	.40	.43⅓	.46⅔
3	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70
4	.06⅔	.13⅓	.20	.26⅔	.33⅓	.40	.46⅔	.53⅓	.60	.66⅔	.73⅓	.80	.86⅔	.93⅓
5	.08⅓	.16⅔	.25	.33⅓	.41⅔	.50	.58⅓	.66⅔	.75	.83⅓	.91⅔	1.00	1.08⅓	1.16⅔
6	.10	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40
7	.11⅔	.23⅓	.35	.46⅔	.58⅓	.70	.81⅔	.93⅓	1.05	1.16⅔	1.28⅓	1.40	1.52	1.63⅓
8	.13⅓	.26⅔	.40	.53⅓	.62⅔	.80	.93⅓	1.06⅔	1.20	1.33⅓	1.46⅔	1.60	1.73⅓	1.86⅔
Days.														
1	.16⅔	.33⅓	.50	.66⅔	.83⅓	1.00	1.16⅔	1.33⅓	1.50	1.66⅔	1.83⅓	2.00	2.17	2.33⅓
2	.33⅓	.66⅔	1.00	1.33⅓	1.66⅔	2.00	2.33⅓	2.66⅔	3.00	3.33⅓	3.66⅔	4.00	4.34	4.66⅔
3	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.51	6.99⅔
4	.66⅔	1.33⅓	2.00	2.66⅔	3.33⅓	4.00	4.66⅔	5.33⅓	6.00	6.66⅔	7.33⅓	8.00	8.68	9.33
5	.83⅓	1.66⅔	2.50	3.33⅓	4.16⅔	5.00	5.83⅓	6.66⅔	7.50	8.33⅓	9.16⅔	10.00	10.85	11.66⅔
6	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00

Trade Discount Table

From the Business Man's Pocket Book, by permission of the owners of the copyright. The International Text Book Company, proprietors of the International Correspondence Schools of Scranton, Pa.

Rate Per Cent.	Equivalent	Net	Rate Per Cent.	Equivalent	Net
2½	.0250	.9750	25 and 10	.3250	.6750
2½ and 2½	.0494	.9506	25, 10 and 2½	.3419	.6581
2½ and 5	.0738	.9262	25, 10, and 5	.3588	.6412
2½, 5, and 2½	.0969	.9031	25, 10, and 7½	.3756	.6244
2½, 5, and 5	.1201	.8799	25, 10, and 10	.3925	.6075
2½, 5, 5, and 2½	.1421	.8579	27½	.2750	.7250
2½ and 10	.1225	.8775	27½ and 2½	.2931	.7069
2½, 10 and 2½	.1444	.8556	27½, 2½, and 2½	.3108	.6892
2½, 10, and 5	.1660	.8340	27½ and 5	.3113	.6887
2½, 10, 5, and 2½	.1872	.8128	27½, 5, and 2½	.3285	.6715
2½, 10, and 10	.2103	.7897	27½, 5, and 5	.3457	.6543
5	.0500	.9500	27½ and 7½	.3294	.6706
5 and 2½	.0738	.9262	27½, 7½, and 2½	.3462	.6538
5 and 5	.0975	.9025	27½, 7½, and 5	.3629	.6371
5, 5, and 2½	.1201	.8799	27½, 7½, and 7½	.3797	.6203
5, 5, and 5	.1426	.8574	27½ and 10	.3475	.6525
5, 5, 5, and 2½	.1640	.8360	27½, 10, and 2½	.3638	.6362
10	.1000	.9000	27½, 10, and 5	.3801	.6199
10 and 2½	.1225	.8775	27½, 10, and 7½	.3964	.6036
10 and 5	.1450	.8550	27½, 10, and 10	.4128	.5872
10, 5, and 2½	.1664	.8336	30	.3000	.7000
10, 5, and 5	.1878	.8122	30 and 2½	.3175	.6825
10, 5, 5, and 2½	.2081	.7919	30, 2½, and 2½	.3346	.6654
10 and 10	.1900	.8100	30 and 5	.3350	.6650
10, 10, and 2½	.2103	.7897	30, 5, and 2½	.3516	.6484
10, 10, and 5	.2305	.7695	30, 5, and 5	.3683	.6317
10, 10, 5, and 2½	.2497	.7503	30 and 7½	.3525	.6475
10, 10, and 10	.2710	.7290	30, 7½, and 2½	.3687	.6313
15	.1500	.8500	30, 7½, and 5	.3849	.6151
15 and 2½	.1713	.8287	30, 7½, and 7½	.4011	.5989
15 and 5	.1925	.8075	30 and 10	.3700	.6300
15, 5, and 2½	.2127	.7873	30, 10, and 2½	.3858	.6142
15, 5, and 5	.2329	.7671	30, 10, and 5	.4015	.5985
15, 5, 5, and 2½	.2521	.7479	30, 10, and 7½	.4173	.5827
15 and 10	.2350	.7650	30, 10, and 10	.4330	.5670
15, 10, and 2½	.2541	.7459	32½	.3250	.6750
15, 10, and 5	.2733	.7267	32½ and 2½	.3419	.6581
15, 10, 5, and 2½	.2915	.7085	32½, 2½, and 2½	.3584	.6416
15, 10, and 10	.3115	.6885	32½ and 5	.3588	.6412
20	.2000	.8000	32½, 5, and 2½	.3748	.6252
20 and 2½	.2200	.7800	32½, 5, and 5	.3909	.6091
20 and 5	.2400	.7600	32½ and 7½	.3756	.6244
20, 5, and 2½	.2590	.7410	32½, 7½, and 2½	.3912	.6088
20, 5, and 5	.2780	.7220	32½, 7½, and 5	.4068	.5932
20, 5, 5, and 2½	.2962	.7038	32½, 7½, and 7½	.4224	.5776
20 and 10	.2800	.7200	32½ and 10	.3925	.6075
20, 10, and 2½	.2980	.7020	32½, 10, and 2½	.4077	.5923
20, 10, and 5	.3160	.6840	32½, 10, and 5	.4229	.5771
20, 10, 5, and 2½	.3331	.6669	32½, 10, and 7½	.4381	.5619
20, 10 and 10	.3520	.6480	32½, 10, and 10	.4533	.5467
25	.2500	.7500	35	.3500	.6500
25 and 2½	.2688	.7312	35 and 2½	.3663	.6337
25, 2½, and 2½	.2871	.7129	35, 2½, and 2½	.3821	.6179
25 and 5	.2875	.7125	35 and 5	.3825	.6175
25, 5, and 2½	.3053	.6947	35, 5, and 2½	.3979	.6021
25, 5, and 5	.3231	.6769	35, 5, and 5	.4134	.5866
25 and 7½	.3063	.6937	35 and 7½	.3988	.6012
25, 7½ and 2½	.3236	.6764	35, 7½, and 2½	.4138	.5862
25, 7½, and 5	.3410	.6590	35, 7½, and 5	.4288	.5712
25, 7½, and 7½	.3583	.6417	35, 7½, and 7½	.4439	.5561

Trade Discount Table—(Continued)

Rate Per Cent.	Equivalent	Net	Rate Per Cent.	Equivalent	Net
35 and 10	.4150	.5850	42½, 10, and 7½	.5213	.4787
35, 10, and 2½	.4296	.5704	42½, 10 and 10	.5343	.4657
35, 10, and 5	.4443	.5557	45	.4500	.5500
35, 10, and 7½	.4589	.5411	45 and 2½	.4638	.5362
35, 10, and 10	.4735	.5265	45, 2½, and 2½	.4772	.5228
37½	.3750	.6250	45 and 5	.4775	.5225
37½ and 2½	.3906	6094	45, 5, and 2½	.4906	.5094
37½, 2½, and 2½	.4058	.5942	45, 5, and 5	.5036	.4964
37½ and 5	.4063	.5937	45 and 7½	.4913	.5087
37½, 5, and 2½	.4211	.5789	45, 7½, and 2½	.5040	4960
37½, 5, and 5	.4360	.5640	45, 7½, and 5	.5167	.4833
37½ and 7½	.4219	.5781	45, 7½, and 7½	.5295	.4705
37½, 7½, and 2½	.4364	.5636	45 and 10	.5050	.4950
37½, 7½, and 5	.4508	.5492	45, 10, and 2½	.5174	.4826
37½, 7½, and 7½	.4654	.5346	45, 10, and 5	.5298	.4702
37½ and 10	.4375	.5625	45, 10, and 7½	.5421	.4579
37½, 10, and 2½	.4516	.5484	45, 10, and 10	.5545	.4455
37½, 10, and 5	.4656	.5344	47½	.4750	.5250
37½, 10, and 7½	.4797	.5203	47½ and 2½	.4881	.5119
37½, 10, and 10	.4938	.5062	47½, 2½, and 2½	.5009	.4991
40	.4000	.6000	47½ and 5	.5013	.4987
40 and 2½	.4150	.5850	47½, 5, and 2½	.5138	.4862
40, 2½, and 2½	.4296	.5704	47½, 5 and 5	.5262	.4738
40 and 5	.4300	.5700	47½ and 7½	.5144	.4856
40, 5, and 2½	.4443	.5557	47½, 7½, and 2½	.5265	.4735
40, 5, and 5	.4585	.5415	47½ 7½, and 5	.5387	.4613
40 and 7½	.4450	.5550	47½, 7½, and 7½	.5509	.4491
40, 7½, and 2½	.4589	.5411	47½ and 10	.5275	.4725
40, 7½, and 5	.4728	.5272	47½, 10, and 2½	.5393	.4607
40, 7½, and 7½	.4866	.5134	47½, 10, and 5	.5511	.4489
40 and 10	.4600	.5400	47½, 10, and 7½	.5629	.4371
40, 10, and 2½	.4735	.5265	47½, 10, and 10	.5748	.4252
40, 10, and 5	.4870	.5130	50	.5000	.5000
40, 10, and 7½	.5005	.4995	50 and 2½	.5125	.4875
40, 10, and 10	.5140	.4860	50, 2½, and 2½	.5247	.4753
42½	.4250	.5750	50 and 5	.5250	.4750
42½ and 2½	.4394	.5606	50, 5, and 2½	.5369	.4631
42½, 2½, and 2½	.4534	.5466	50, 5, and 5	.5488	.4512
42½ and 5	.4538	.5462	50 and 7½	.5375	.4625
42½, 5, and 2½	.4675	.5325	50, 7½, and 2½	.5491	.4509
42½, 5, and 5	.4811	.5189	50, 7½, and 5	.5606	.4394
42½ and 7½	.4681	.5319	50, 7½, and 7½	.5722	.4278
42½, 7½, and 2½	.4814	.5186	50 and 10	.5500	.4500
42½, 7½, and 5	.4947	.5053	50, 10, and 2½	.5613	.4387
42½, 7½, and 7½	.5080	.4920	50, 10, and 5	.5725	.4275
42½ and 10	.4825	.5175	50, 10, and 7½	.5838	.4162
42½, 10, and 2½	.4954	.5046	50, 10, and 10	.5950	.4050
42½, 10, and 5	.5084	.4916			

THE SEVEN WONDERS OF THE WORLD.

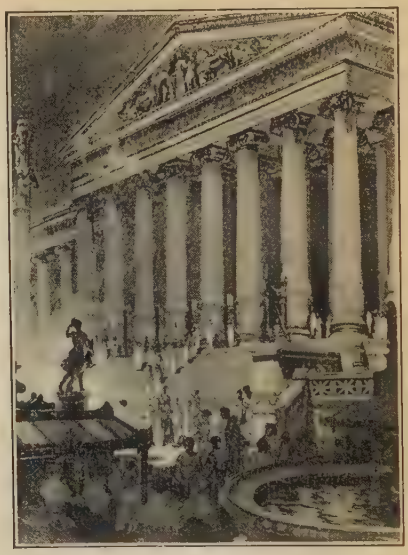
ANCIENT

The Seven Wonders of the World, so-called, or rather the Seven Wonders of the Ancient World, were as follows: The Pharos of Alexandria; The Colossus of Rhodes; The Great Temple of Diana at Ephesus; The Hanging Gardens of Babylon; The Pyramids; The Tomb of Mausolus; and the Great Statue of Jupiter at Olympia. All of the Seven Wonders were situated on the shores of the eastern part of the Mediterranean. If the Greek writers had been better acquainted with the north of Europe or the south of Asia, they would probably have made a different selection.

MODERN

The Seven Wonders of the Modern World, according to the poll of a thousand scientists in America and Europe, are, in the order of importance, with the votes cast; Wireless telegraphy, 244 votes; telephone, 185; aeroplane, 167; radium, 165; spectrum analysis, 126; X-ray, 111. The Panama Canal was given 100 votes; anesthesia, 94, and synthetic chemistry, 81. Only one ballot, bearing the name of one of the most distinguished authorities on chemistry of Munich, Germany, was checked for the seven titles, while six ballots showed the selection of six of the final seven.

THE PHAROS OF ALEXANDRIA.



THE GREAT TEMPLE OF DIANA AT EPHESUS.

Courtesy of "The Sphere."

THE COLOSSUS OF RHODES.

THE HANGING GARDENS OF BABYLON.

Courtesy of "The Sphere."

THE STATUE OF JUPITER AT OLYMPIA

THE TOMB OF MAUSOLUS.

Courtesy of "The Sphere." THE PYRAMIDS OF EGYPT.

DEPARTMENT OF AGRICULTURE.

The Secretary of Agriculture exercises personal supervision of public business relating to the agricultural industry. He appoints all the officers and employees of the department with the exception of the Assistant Secretary and the Chief of the Weather Bureau, who are appointed by the President, and directs the management of all the bureaus, divisions, and offices embraced in the department. He exercises advisory supervision over agricultural experiment stations which receive aid from the National Treasury.

BUREAU OF ANIMAL INDUSTRY.

The Bureau of Animal Industry conducts the inspection of animals, meats, and meat-food products under the act of Congress of June 30, 1906, and has charge of the inspection of import and export animals. It makes special investigations in regard to dairy subjects.

FOREST SERVICE.

The Bureau of Forestry gives practical advice in the conservative handling of forest lands; investigates methods of forest planting, and gives practical advice to tree planters; investigates the control and prevention of forest fires, and other forest problems.

BUREAU OF CHEMISTRY.

The Bureau of Chemistry makes such investigations and analyses as pertain in general to the interests of agriculture, dealing with fertilizers and agricultural products. It inspects the conditions of manufacture, transportation, and sale of food and drug products for the purpose of determining whether such products are adulterated or misbranded within the meaning of the Pure Food and Drugs Act of June 30, 1906. Also inspects imported and exported food products.

BUREAU OF SOILS.

The Bureau of Soils has for its object the investigation of soils in their relation to crops, the mapping of soils, and the investigation, mapping, and reclamation of alkali lands.

BUREAU OF PLANT INDUSTRY.

The Bureau of Plant Industry studies plant life in all its relations to agriculture. It includes vegetable, pathological and physiological, botanical, pomological and grass and forage plant investigations.

BUREAU OF ENTOMOLOGY.

The Bureau of Entomology obtains and disseminates information regarding injurious insects affecting field crops, fruits, small fruits, and truck crops, forests and forest products, and stored products.

BUREAU OF BIOLOGICAL SURVEY.

The Bureau of Biological Survey investigates the economic relation of birds and mammals and recommends measures for the preservation of beneficial and the destruction of injurious species. It also studies the geographical distribution of animals and plants and maps the natural life zones of the country.

OFFICE OF EXPERIMENT STATIONS.

The Office of Experiment Stations represents the department in its relations with the agricultural colleges and experiment stations, which are now in operation in all the States, and directly manages the experiment stations in Alaska, Hawaii, Porto Rico, and Guam. It seeks to promote the interest of agricultural education and investigation throughout the United States.

CHAPTER VI.

MERCHANT MARINE.

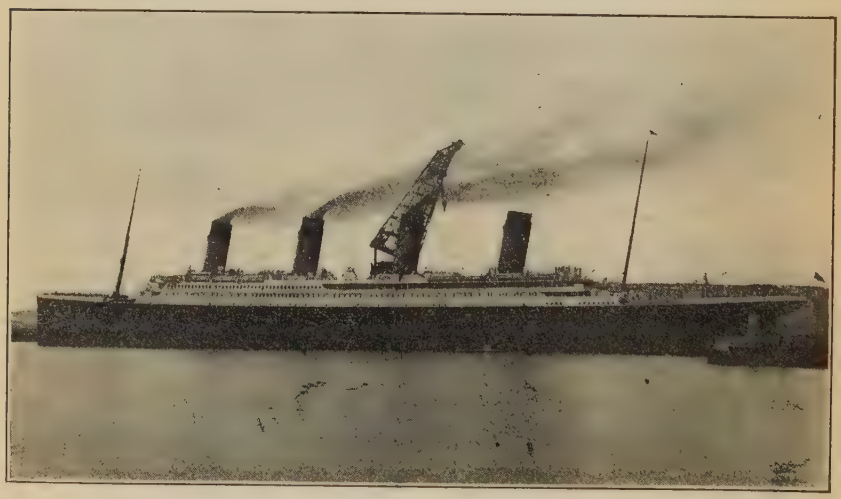
NUMBER AND NET AND GROSS TONNAGE OF STEAM AND SAILING VESSELS OF OVER 100 TONS, OF THE SEVERAL COUNTRIES OF THE WORLD, AS RECORDED IN LLOYD'S REGISTER FOR 1911–12.

Flag.	Steam.			Sail.		Total.	
	Number.	*Net tons.*	*Gross tons.*	*Number.*	*Net tons.*	*Number.*	*Tonnage.*
British:							
United Kingdom	8,487	10,519,076	17,292,715	847	579,982	9,334	17,872,697
Colonies	1,414	788,580	1,350,934	694	195,193	2,108	1,546,127
Total	9,901	11,307,656	18,643,649	1,541	775,175	11,442	19,418,824
American (United States):							
Sea	1,115	1,117,446	1,715,427	1,647	1,093,257	2,762	2,808,684
Lakes	579	1,666,524	2,201,866	35	99,757	614	2,301,623
Philippine Islands	76	28,379	45,087	14	2,884	90	47,971
Total	1,770	2,812,349	3,962,380	1,696	1,195,898	3,466	5,158,278
Argentinian	212	91,890	154,851	67	22,228	279	177,079
Austro-Hungarian	377	528,588	844,981	5	1,507	382	846,488
Belgian	154	184,963	284,662	6	3,723	160	288,385
Brazilian	342	161,245	263,211	67	17,297	409	280,508
Chilean	98	71,646	112,589	42	37,427	140	150,016
Chinese	66	55,678	86,550	.....	.....	66	86,550
Cuban	57	37,085	59,988	9	2,563	66	62,551
Danish	551	406,866	692,718	303	60,036	854	752,754
Dutch	559	635,155	1,029,596	100	28,691	659	1,058,287
French	890	887,985	1,542,568	588	434,294	1,478	1,976,862
German	1,856	2,494,922	4,092,015	343	374,865	2,199	4,466,880
Greek	322	349,581	560,475	98	25,395	420	585,870
Haitian	5	2,017	3,387	.....	.....	5	3,387
Italian	479	620,276	1,026,823	598	313,685	1,077	1,340,508
Japanese	831	760,867	1,200,975	5	2,245	866	1,203,220
Mexican	42	21,334	34,733	16	3,878	58	38,611
Norwegian	1,373	928,084	1,537,873	697	616,458	2,070	2,154,331
Peruvian	16	10,979	20,130	40	19,909	56	40,089
Portuguese	98	46,246	77,945	101	27,507	199	105,452
Roumanian	22	16,690	31,688	1	285	23	31,973
Russian	649	414,975	710,951	542	184,307	1,191	895,258
Sarawak	5	2,204	3,673	.....	.....	5	3,673
Siamese	13	8,307	13,499	.....	.....	13	13,499
Spanish	526	463,751	758,097	65	17,454	591	775,551
Swedish	975	476,166	808,898	465	122,584	1,440	931,482
Turkish	162	85,507	141,778	179	60,914	341	202,692
Uruguayan	38	30,770	49,918	14	9,984	52	59,902
Venezuelan	8	2,420	4,232	5	679	13	4,911
Other countries: Bulgaria, Colombia, Costa Rica, Ecuador, Egypt, Honduras, Liberia, Nicaragua, Oman, Panama, Persia, Salvador, Samos, Zanzibar, etc.	46	15,549	26,739	21	6,594	67	33,333
Total	22,473	23,931,751	38,781,572	7,614	4,365,582	30,087	43,147,154

For valuable information relative to ocean travel the reader is referred to the "Scientific American Handbook of Travel," published by Munn & Co., Inc., and compiled and edited by Albert A. Hopkins. It is the standard book on the subject, and the tables, etc., in this Chapter bring it up to date.

MERCHANT MARINE OF THE UNITED STATES.

On June 30, 1911, the merchant marine of the United States, including all kinds of documented shipping, comprised 25,991 vessels of 7,638,790 gross tons. Of this number 16,881, having gross tons of 3,559,805, were operating on the Atlantic and Gulf coasts; 3,834 vessels, with a tonnage of 954,425, were operating on the Pacific coast. The power and material of these vessels were as follows: Sailing vessels—Wood, 8,067, gross tons 1,345,515; metal, 137, gross tons 252,308; total, 8,204, with a gross tonnage of 1,597,823. Of steam vessels 11,300, having a tonnage of 1,125,562, were made of wood, and 2,007, with a tonnage of 3,948,507, were built of metal, making a total of 13,307 vessels, having a tonnage of 5,074,069. There are also 659 wooden canal boats having a tonnage of 72,370, and 3,659 wooden and 162 metal barges, having a combined tonnage of 894,528, making a grand total of 7,638,790 tons. During the year 1,422 vessels, having a gross tonnage of 291,162, were constructed. Of this number 112 metal vessels had a tonnage of 195,964.



THE "TITANIC" LEAVING HER BUILDER'S FOR HER MAIDEN AND ONLY VOYAGE.

The largest floating dock in the world is to be built at Kiel. It will have a lifting capacity of 40,000 tons. Its length will be 656 feet, its width 141 feet; and its submergible depth 35¼ feet. Hamburg plans to have three docks, the smallest of which is now being built, of 35,000, 34,000 and 20,000 pounds lifting capacity. Their lengths will be 720, 733⅜ and 511¼ feet, respectively; their widths, 108½, 108½ and 97 feet; and their submergible depths, 33, 33 and 26 feet. The docks at Medway and Portsmouth will each have a lifting capacity of 32,000 tons; a length of 680 feet; a width of 113 feet; and a submergible depth of 36 feet. Montreal's docks, when completed, will have a lifting capacity of 25,000 tons; a length of 600 feet; a width of 100 feet; and a submergible depth of 27½ feet. Pola intends to build a dock with a lifting capacity of 22,000 pounds; length 584 feet; width, 111½ feet, and submergible depth, 27 feet. Rio de Janeiro has a dock with lifting capacity, 22,000 tons; length, 550 feet; width, 100 feet, and submergible depth, 30 feet.

Shipbuilding statistics for 1911 in the United States accounted for 1,702 new merchant ships of all descriptions, aggregating 243,792 gross tons, as compared with 1,208 ships of 203,158 gross tons built during 1910. Thirty-five steel vessels were built on the Great Lakes, including two of 8,603 gross tons, the largest vessels in the lake service. Fourteen steel vessels, of 30,039 gross tons, were built for the Atlantic service.

MERCANTILE FLEETS—BRITISH AND FOREIGN.

Lines.	Head Office.	Total Tonnage.	Over 20 knots	Knots. 20	19	18	17	16	15	14	13	12	Under 12 knots.	Total.
Hamburg-American	Hamburg	908,000	...	1	...	...	2	6	4	7	14	45	87	166
Norddeutscher Lloyd	Bremen	718,000	4	...	1	1	2	4	11	8	20	27	55	133
White Star	Liverpool	495,000	3	2	...	1	5	4	1	...	11	...	6	33
Pittsburgh S.S. Co.	Cleveland	482,000*	...	...	...	...	...	...	...	...	...	...	...	108
British India Steam N. Co.	London	472,000	...	...	...	...	4	11	4	10	3	25	55	112
P. & O. Steam N. Co.	London	465,000	2	1	1	16	3	7	3	20	7	1	3	64
"Blue Funnel" Line	Liverpool	457,000	...	...	...	...	...	...	...	25	22	12	11	70
Ellerman Lines, Ltd.	Liverpool	386,000	...	...	...	...	...	...	2	3	7	33	49	94
Compagnie Générale Trans.	Paris	322,000	3	1	1	2	8	4	6	6	1	10	36	78
Union-Castle Line	London	320,000	...	...	...	...	11	2	...	3	5	13	10	44
Messageries Maritimes	Paris	293,000	...	...	...	...	10	4	...	1	22	22	6	65
Furness, Withy & Co., Ltd.	West Hartlepool	287,000	...	...	...	...	...	...	...	...	4	6	82	92
Nippon Yusen Kaisha	Tokio	282,000	...	...	...	...	...	1	9	10	18	4	28	70
Hansa	Bremen	276,000	...	...	...	...	...	...	...	...	...	...	...	56
Cunard	Liverpool	266,000	3	...	...	2	...	4	1	1	2	...	11	24
Leyland	Liverpool	263,000	...	...	...	...	...	...	...	6	9	16	13	44
Harrison	Liverpool	242,000	...	...	...	...	...	...	...	...	30	11	5	46
Austrian Lloyd	Trieste	239,000	...	...	...	...	2	3	3	8	21	13	14	64
Clan	Glasgow	238,000	...	...	...	...	...	...	...	7	...	23	26	56
Royal Mail S.P. Co.	London	228,000	...	...	...	...	...	...	16	...	2	4	25	47
Lamport & Holt	Liverpool	212,000	...	...	...	...	...	...	...	4	3	14	22	43
Hamburg-South American	Hamburg	207,000	...	...	...	...	1	...	2	1	1	5	40	50
Wilson	Hull	196,000	...	...	...	...	1	1	1	3	7	13	55	81
Canadian Pacific Railway	Montreal	192,000	...	2	2	1	...	5	4	...	7	12	36	69
Union S.S. Co. of N. Zealand.	Dunedin	192,000	...	1	1	...	1	2	5	10	6	9	35	70
Elder, Dempster & Co., Ltd.	Liverpool	190,000	...	...	...	...	1	...	1	4	13	13	58	90
Kosmos	Hamburg	190,000	...	...	...	...	...	...	...	...	...	13	25	38
Deutsche-Australische	Hamburg	188,000	...	...	...	...	...	...	...	...	...	...	41	41
Allan	Glasgow	186,000	...	...	...	2	2	4	3	1	1	6	6	25
Pacific Steam N. Co.	Liverpool	183,000	...	...	...	...	...	3	6	4	3	17	4	37
Maclay & McIntyre	Glasgow	182,000	...	...	...	...	...	...	...	...	...	...	50	50
R. Ropner & Co.	West Hartlepool	168,000	...	...	...	...	...	...	...	...	...	...	53	53
Anglo-American Oil Co., Ltd.	London	163,000*	...	...	...	...	...	...	...	...	...	...	...	41
Osaka S. K., Ltd.	Osaka	154,000	...	...	...	...	...	...	...	...	2	7	100	109
Forenede Dampskibs Selskab	Copenhagen	153,000	...	...	...	...	...	5	3	2	7	3	100	120
Unione Austriaca di Nav.	Trieste	148,000	...	...	...	...	1	2	2	2	5	5	15	32
Chargeurs Réunis	Paris	146,000	...	...	...	...	...	4	1	1	9	10	...	25
Gilchrist Transportation Co.	Cleveland, Ohio	146,000	...	...	...	...	...	...	...	...	...	...	...	34
Societa Anonima Nazionale di Servizi Marittimi	Rome	146,000	...	...	...	...	...	...	5	...	19	18	21	63
Nederland Line	Amsterdam	145,000	...	...	...	...	...	...	2	8	6	...	12	28
Bucknall S.S. Lines, Ltd.	London	136,000	...	...	...	...	...	...	...	...	3	14	7	24
Hugh & W. Nelson, Ltd.	Liverpool	131,000	...	...	...	...	...	...	...	10	6		4	20
New Zealand Shipping Co.	London	131,000	...	...	...	...	7	...	...	6	...	4	...	17
Burrell & Son	Glasgow	130,000	...	...	...	...	...	...	...	...	...	...	...	30
W. Wilhelmsen	Tonsburg	130,000	...	...	...	...	...	...	...	...	...	...	...	35
Anchor	Glasgow	128,000	...	...	...	...	1	2	1	1	5	8	3	21
Prince	Newcastle-on-Tyne	128,000	...	...	...	...	...	...	1	...	...	13	21	35
Holland-American	Rotterdam	125,000	...	...	...	...	1	1	3	...	...	...	8	13
Booth	Liverpool	123,000	...	...	...	...	...	...	1	5	1	2	24	33
Andrew Weir & Co.	Glasgow	122,000*	...	...	...	...	...	...	...	...	4	...	20	36
Wm. Ruys & Sons	Rotterdam	122,000	...	...	...	...	...	...	...	8	...	5	17	30
Anglo-Saxon Petroleum Co.	London	121,000	...	...	...	...	...	...	...	...	...	...	...	42
China Nav. Co., Ltd.	London	117,000	...	...	...	...	...	...	...	...	...	...	...	61
Moor Line	Newcastle-on-Tyne	116,000	...	...	...	...	...	...	...	...	...	...	...	33
American-Hawaiian S.S. Co.	New York	116,000	...	...	...	...	...	...	...	1	10	6	...	17
Edward Hain & Son	St. Ives	116,000	...	...	...	...	...	...	...	...	...	...	33	33
Deutsche Levante Linie	Hamburg	114,000	...	...	...	...	...	...	...	...	...	...	...	45
Koninklijke Paketvaart M.	Amsterdam	111,000	...	...	...	...	...	...	1	2	...	24	47	74
Houlder Bros. & Co., Ltd.	London	107,000	...	...	...	...	...	...	...	...	4	3	15	22
Southern Pacific Co.	New York	105,000	...	...	...	...	...	3	11	3	1	5	...	23
Red Star Line	Antwerp	105,000	...	...	...	1	...	3	...	2	1	...	3	10
Orient Line	London	104,000	...	...	...	9	1	...	...	...	...	...	...	10
Lloyd Brazileiro	Rio de Janeiro	103,000	...	...	...	...	...	...	...	1	4	3	59	67
Thomas (Evan) Radcliffe & Co.	Cardiff	102,000	...	...	...	...	...	...	...	...	...	...	...	29
C. T. Bowring & Co., Ltd.	Liverpool	100,000	...	...	...	...	...	...	...	...	2	3	28	33
Nav. Gen. Italiana	Genoa	100,000	...	...	...	...	...	6	...	5	...	2	14	27

Courtesy of "Whitaker's Almanack." * Steam and Sail.

THE "IMPERATOR."

The "Imperator," the largest ship yet constructed and built for the Hamburg-American Company at the Vulcan Yards, Hamburg, is 900 feet long, has a beam of 96 feet and a molded depth of 62 feet. She will have nine decks above the water line, and the boat deck will accommodate 52 life-boats besides rafts. The trucks of the masts will be 246 feet above the keel, exceeding that of the loftiest vessel

LARGEST VESSEL AFLOAT.

afloat. The funnels will be 69 feet long, and the oval openings will measure 29 feet by 18 feet. The rudder alone weighs 90 tons, and the diameter of the rudder stock is 2 ½ feet.

The ship will be driven by turbines of 70,000 horse-power, which will be developed on four shafts. One of the immense rotors, containing 50,000 blades, weighs 135 tons, and is capable of developing over 22,000 horse-power. The casing is 18 feet in diameter and 25 feet long. The shafting of all four propellers is 1 ½ feet in diameter. The propellers, which are made of turbadium bronze, are 16 feet 8 inches in diameter. The estimated speed of the ship is 22 ½ knots and she will be equipped with water-tube boilers..

The subdivision of the "Imperator" below the water line has been carried out under the supervision of the Germanic Lloyd's and the Immigration authorities. It consists of a series of intersecting transverse and longitudinal bulkheads. Transversely, the ship is subdivided by twelve bulkheads, which are carried two decks above the water line, with the exception of the collision bulkheads forward, which extend four decks above the same level. These bulkheads are intersected by longitudinal bulkheads, which subdivide the boiler and engine rooms, the under water portion of the ship being divided altogether into twenty-four separate watertight compartments. The coal bunkers are placed above the boiler rooms, and along the sides of the ship.

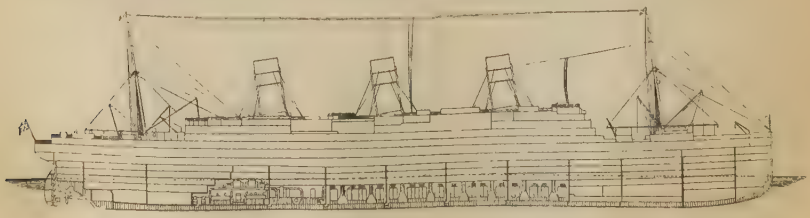
Careful attention has been given to the navigating department of the "Imperator." Two experienced first officers will be on duty, one of whom will devote his efforts solely to the navigation and safety of the ship. Not only will all possible devices and aids be installed, but careful attention to all the requirements of travel at sea, and the laws of the nations regarding same, will be observed by the officers of the ship.

The "Imperator" will have a passenger carrying capacity of 4,250 and a crew numbering about 1,100, including cooks, stewards, etc., and will probably make her maiden trip to New York in the early summer of 1913.

UNITED STATES GEOGRAPHIC BOARD.

The United States geographic board passes on all unsettled questions concerning geographic names which arise in the departments of the government, as well as determining, changing and fixing place names within the United States and its insular possessions. The decisions of the board are to be accepted by all departments as standard authority. The board has advisory powers with respect to the preparation of maps in the various offices and bureaus of the government.

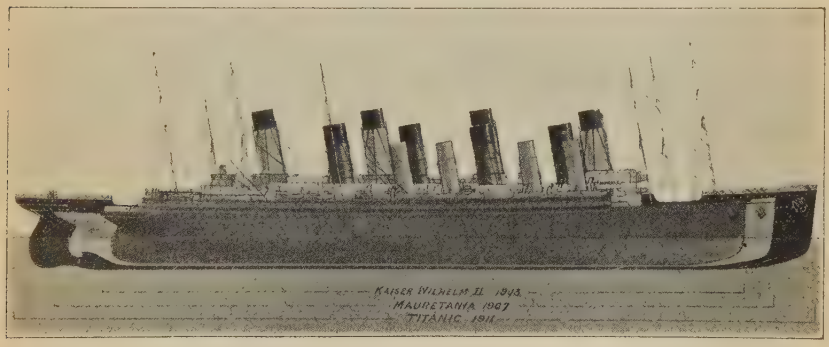
The budget of Holland for 1912 allots a considerable sum for the study of the problem of draining the Zuyder Zee. For over forty years various plans have been suggested.



THE NINE DECKS ABOVE WATER LINE OF THE "IMPERATOR."

SPEED OF VESSELS.

Flag.	Speed in knots.														Total.
	25	24	23	22	21	20	19	18	17	16	15	14	13	12	
British	2	1	4	5	5	16	8	34	29	55	66	130	235	373	963
German			3	1			1	1	4	4	15	25	26	94	174
Dutch				3					1	1	7	18	10	21	61
French				1	2	1	1	2	18	14	7	10	36	43	135
United States					2	5	3	7	10	23	39	42	34	53	218
Japanese						2	1		3	1	9	11	21	9	57
Russian						1	1			2	4	7	4	12	31
Spanish							1			2	2	8	9	2	24
Roumanian								4							4
Peruvian								1							1
Italian						4		1		10	14	18	15	20	82
Belgian								1		3		5	1		10
Austro-Hungarian									3	4	5	2	14	20	48
Danish										3	1			3	7
Swedish										2	1				3
Argentinian										1					1
Greek											1		2		3
Chilean												11			11
Portuguese												1	6		7
Brazilian												1	4		5
Norwegian													1		1
Total	2	1	7	10	9	29	16	51	68	125	171	289	418	650	1,846



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COMPARISON OF LARGE VESSELS UP TO 1911.

Courtesy of "The Sphere."

THE SEARCHLIGHT ON THE LINER.

The World's Fastest Merchant Ships Now in Service.

(Vessels of 22 Knots and over)

	Built	Tons gross	Speed knots
British (25 Ships):			
Ben-My-Chree (turbine)	1908	2,651	25.34
Brighton (turbine)	1903	1,129	22
Campania	1893	12,950	22
Connaught	1897	2,641	23.55
Dieppe (turbine)	1905	1,216	22
Empress (turbine)	1907	1,695	22
Empress Queen (pad.)	1897	2,140	22
Invicta (turbine)	1905	1,680	22.9
Leinster	1897	2,641	23.5
Londonderry (turbine)	1904	1,950	22.3
Lusitania (turbine)	1907	31,550	25.88
Manxman (turbine)	1904	2,174	23.14
Mauretania (turbine)	1907	31,937	26.06
Munster	1897	2,641	23.5
Onward (turbine)	1905	1,671	22.9
Riviera (turbine)	1911	1,750	23.07
St. Andrew (turbine)	1908	2,528	22.50
St. David (turbine)	1906	2,529	22.50
St. George (turbine)	1906	2,456	22.50
St. Patrick (turbine)	1906	2,531	22.50
The Queen (turbine)	1903	1,676	22.25
Ulster	1897	2,641	23.5
Victoria (turbine)	1907	1,689	22
Viking (turbine)	1905	1,951	23.53
Viper (turbine)	1906	1,713	22
Belgian (6 Ships):			
Jan Breydel (turbine)	1909	1,750	24
Leopold II. (pad.)	1892	1,367	22
Marie Henriette (pad.)	1893	1,451	22
Pieter de Coninck (turb.)	1910	1,750	24
Princesse Clementine (pad.)	1896	1,474	22
Princesse Elisabeth (turbine)	1905	1,747	24
Dutch (3 Ships):			
Mecklenburg	1909	2,885	22.50
Oranje Nassau	1909	2,885	22.50
Prinses Juliana	1909	2,885	22.50
French (3 Ships):			
France	1910	27,000	23.27
La Provence	1906	13,753	22
Newhaven (turbine)	1911	—	23
German (4 Ships):			
Kaiser Wilhelm II	1902	19,361	23.25
Kaiser Wilhelm der Grosse	1897	14,349	22.50
Kronprinzessin Cecilie	1907	19,503	23.50
Kronprinz Wilhelm	1901	14,908	23

Courtesy of "Shipping World Year Book."

A Humiliating News Item.

NO U. S. FLAG ON THE THAMES

NOT A VESSEL FLYING IT ENTERED THE PORT OF LONDON LAST YEAR.

By Marconi Transatlantic Wireless Telegraph to The New York Times.

LONDON, May 8.—The Pall Mall Gazette publishes as a startling fact a report by the Medical Officer for the Port of London that no vessel flying the Stars and Stripes arrived in the Thames in the whole of last year.

Time and Watch on Board Ship.

Watch. For purposes of discipline, and to divide the work fairly, the crew is mustered in two divisions—the Starboard (right side, looking forward) and the Port (left). The day commences at noon, and is thus divided:—

Afternoon *Watch*	....	noon to 4 p. m.
First Dog	....	4 p.m. to 6 p.m.
Second Dog	....	6 p.m. to 8 p.m.
First	....	8 p.m. to midnight.
Middle	....	12 p.m. to 4 a.m.
Morning	....	4 a.m. to 8 a.m.
Forenoon	....	8 a.m. to noon.

This makes seven Watches, which enables the crew to keep them alternatively, as the *Watch* which is on duty in the forenoon one day has the afternoon next day, and the men who have only four hours' rest one night have eight hours the next. This is the reason for having *Dog Watches*, which are made by dividing the hours between 4 p.m. and 8 p.m. into two *Watches*.

Time.—Time is kept by means of "Bells," although there is but one bell on the ship, and to strike the clapper properly against the bell requires some skill.

First, two strokes of the clapper at the interval of a second, then an interval of two seconds; then two more strokes with a second's interval apart, then a rest of two seconds, thus:—

Bell, one second; B., two secs.; B. s.; B. ss.; B. s.; B. ss.; B.

1. Bell is struck at 12.30, and again at 4.30 6.30, 8.30 p.m.; 12.30, 4.30, and 8.30 a.m.

2 Bells at 1 (struck with an interval of a second between each—B. s. B.), the same again at 5, 7, and 9 p.m.; 1, 5, and 9 a.m.

3 Bells at 1.30 (B. s, B. ss, B.) 5.30, 7.30, and 9.30 p.m.; 1.30, 5.30, and 9.30 a.m.

4 Bells at 2 (B. s, B. ss, B. s, B.) 6 and 10 p.m.; 2, 6, and 10 a.m.

5 Bells at 2.30 (B. s, B. ss, B. s, B. ss, B.) and 10.30 p.m.; 2.30, 6.30, and 10.30 a.m.

6 Bells at 3 (B. s, B. ss, B. s, B. ss, B. s, B.) and 11 p.m.; 3, 7, and 11 a.m.

7 Bells at 3.30 (B. s, B. ss, B. s, B. ss, B. s, B. ss, B) and 11.30 p.m.; 3.30, 7.30, and 11.30 a.m.

8 Bells (B. s, B. ss, B. s, B. ss, B. s, B. ss,. B, s. B.) every 4 hours, at noon, at 4 p.m. 8 p.m., midnight, 4 a.m., and 8 a.m.

Depth of the Sea.

	Yards depth. Average.	Max.
Atlantic	4,026	7,750
Pacific	4,252	9,310
Indian	3,658	6,040
Arctic	1,690	5,300
Antarctic	3,000	3,950
Mediterranean	1,476	2,860
Irish	240	710
English Channel	110	300
German	96	..
Levant	72	..
Adriatic	45	..
Baltic	43	..

The Southern Ocean below Cape Horn reaches a depth of 5,500 yards, and off Cape of Good Hope, 5,700 yards. The average depth of the Bay of Biscay is 1,200 yards.

DIAGRAMMATIC VIEW OF THE BED OF THE ATLANTIC SHOWING WHERE THE "TITANIC" LIES."

In the centre are the ridges, so well known to oceanographic students. On each side of this ridge are more or less corresponding depths. The "Titanic" is understood to be lying on the 1,000 to 2,000 fathom shelf, which actually is several miles wide. From "The Sphere."

LOWEST OCEAN RATES.

To and from New York, English and Continental Ports.
(Subject to change without notice.)

Lines.	1st Class to or from Europe.	2d Class to or from England.	2d Class to or from Continent.
American Line			
SSs. New York, St. Paul, St. Louis and Philadelphia	$95.00	$52.50	$60.00
PHILADELPHIA-LIVERPOOL STEAMERS			
SSs. Haverford and Merion	52.50	.....	.....
SSs. Dominion	50.00	.....	.....
Atlantic Transport Line			
SSs. Minneapolis, Minnetonka, Minnehaha, Minnewaska	85.00	.....	.....
Anchor Line			
SSs. Columbia, Caledonia and Cameronia	75.00	50.00	.....
SS. California	70.00	50.00	.....
Austro-Americana			
Kaiser Franz-Joseph I.	80.00	.....	65.00
SS. Martha Washington	75.00	.....	65.00
SSs. Laura, Alice, Argentina and Oceania	70.00	.....	50.00
Cunard Line		.....	
SSs. Lusitania and Mauretania	127.50	65.00	70.00
SS. Campania	105.00	55.00	60.00
SSs. Carmania and Caronia	100.00	57 50	62.50
BOSTON-LIVERPOOL SERVICE			
SSs. Franconia, Laconia	92.50	52.50	57.50
Ivernia and Saxonia	85.00	50.00	55.00
MEDITERRANEAN SERVICE			
SSs. Franconia and Laconia	100.00	.....	65.00
SSs. Caronia and Carmania	105.00	.....	65.00
SSs. Ivernia and Saxonia	85.00	.....	65.00
SS. Carpathia	82.50	.....	65.00
SS. Pannonia	75.00	.....	55.00
French Line			
SS. France	100.50	.....	70.00
SS. La Provence	110.00	.....	65.00
SSs. La Savoie and La Lorraine	100.00	.....	62.50
SSs. La Touraine and Espagne	90.00	.....	60.00
SS. Rochambeau	.....	.....	57.50
SSs. Chicago and Niagara	.....	.....	55.00
SSs. Floride and Caroline	.....	.....	47.50
Fabre Line			
SS. Sant' Anna and Canada	70.00	.....	55.00
SS. Madonna	75.00	.....	.....
SSs. Roma and Germania	75.00	.....	55.00
Hamburg-American Line			
SSs. Amerika and Kaiserin Aug. Victoria	115.00	60.00	65.00
SSs. Cleveland, Cincinnati and Victoria Luise	97.50	57 50	60.00
SSs. Moltke and Bluecher	95.00	55.00	60.00
SSs. President Lincoln, President Grant and Hamburg	90.00	55.00	60.00
SSs. Graf Waldersee and Pennsylvania	.....	.....	57.50
MEDITERRANEAN SERVICE			
SS. Moltke	95.00	.....	65.00
SS. Hamburg	90.00	.....	65.00
SS. Batavia	.....	.....	65.00
Holland-America Line			
SS. Rotterdam	107.50	57.50*	62.50
SS. New Amsterdam	95.00	55.00*	57.50
SS. Noordam and other ships	85.00	.....	55.00
Italian Royal Mail Lines			
SSs. Verona and Ancoma	80.00	.....	65.00
SSs. Duca d'Aosta, Duca degli Abruzzi, Duca de Genova	80.00	.....	65.00
SSs. America, Europa and Oceania	80.00	.....	65.00
PHILADELPHIA-MEDITERRANEAN SERVICE			
All steamers	80.00	.....	.....
Lloyd Sabaudo			
SS. Tomaso di Savoia	75.00	.....	65.00
All other steamers	70.00	.....	65.00

* New York to Plymouth only.

LOWEST OCEAN RATES—Continued.

Lines.	1st Class to or from Europe.	2d Class to or from England.	2d Class to or from Continent.
North German Lloyd			
SSs. Kronprinzessin Cecilie and Kaiser Wilhelm II.	125.00	65.00	70.00
SSs. Kronprinz Wilhelm, Kaiser Wilhelm der Grosse	122.50	65.00	70.00
SS. George Washington	115.00	60.00	65.00
SS. Prinz Friedrich Wilhelm	100.00	57.50	62.50
SS. Grosser Kurfuerst	95.00	55.00	60.00
SS. Barbarossa and other ships	90.00	55.00	60.00
MEDITERRANEAN SERVICE			
SS. Berlin	100.00	.....	65.00
All other steamers	90.00	.....	65.00
Red Star Line			
SS. Lapland	97.50	57.50	60.00
SSs. Finland, Kroonland and Vaderland	85.00	55.00	55.00
PHILADELPHIA-ANTWERP SERVICE			
All steamers	.....	.....	55.00
Russian-American Line.			
SSs. Russia, Kuvsk and Czar *	.....	.....	.....
Scandinavian-American Line			
All steamers	77.50	.....	.....
White Star Line			
SS. Olympic	130.00	65.00	70.00
SS. Adriatic	110.00	57.50	.....
SS. Oceanic	110.00	57.50	62.50
SSs. Majestic	95.00	52.50	60.00
SSs. Baltic, Cedric and Celtic	100.00	55.00	.....
BOSTON-LIVERPOOL SERVICE			
SS. Arabic	85.00	50.00	.....
SS. Cymric	.....	52.50	.....
MEDITERRANEAN SERVICE			
SS. Canopic	85.00	.....	65.00
SS. Cretic	82.50	.....	65.00

* The minimum first class fare from New York to Rotterdam is $65.00 and to Libau $75.00. Second class fare from New York to Rotterdam is $48.00 and to Libau $50.00. The minimum first class fare from Libau to New York is $70.00 and second class fare $57.50.

The above are the lowest or minimum rates from port to port. Through rates to London or Paris should be made by adding to the above rates the following railroad rates of class and from desired port:

From Liverpool to London: 1st Class, $7.00. In connection with 2d Class ocean tickets a 3d Class railroad ticket is furnished for $2.50. Fishguard to London, 1st Class, $8.25, and 3d Class, $2.50, in connection with 2d Class ocean tickets.

From Liverpool to Paris: 1st class $21.00; Fishguard to Paris $22.25. In connection with 2d Class ocean tickets, transportation is provided from Liverpool and Fishguard on payment of $7.50.

From Plymouth to London: 1st Class, $7.50; 2d Class, $4.75; 3d Class, $3.75.
From Dover to London: 1st Class, $4.75; 2d Class, $3.15.
From Southampton to London: 1st Class, $2.75; 2d Class, $1.75; 3d Class, $1.40.
From Cherbourg to Paris: 1st Class, $8.75; 2d Class, $6.25; 3d Class, $3.60.
From Havre to Paris: 1st Class, $5.60; 2d Class, $4.00; 3d Class, $2.50.
From Boulogne-sur-Mer to Paris: 1st Class, $5.50; 2d Class, $3.70.

PACIFIC MAIL STEAMSHIP COMPANY.—PANAMA LINE.

Between San Francisco and Mazatlan, San Blas, Manzanillo, Acapulco, Salina Cruz, Ocos, Champerico, San Jose de Guatemala, Acajutla, La Libertad, La Union, Amapala, Corinto, San Jose del Sue, Punta Arenas, Balboa (Panama).

San Francisco and Panama, $120. Round Trip, $216. Steerage, $60. San Francisco and New York, $120. Steerage, $65. San Francisco and New Orleans, $120. First class only.

New express, passenger and freight service direct for Panama and New York, calling only at San Pedro (Los Angeles) en route. San Francisco to Panama, $85. Round Trip, $150. To New York, $120. To New Orleans, $120.

PACIFIC COAST STEAMSHIP COMPANY.

Between Seattle, Wash., Victoria and Vancouver, B. C., and Ketchikan, Metlakatla, Rudyerd Fiord, Wrangelli, Juneau, Douglas, Treadwell Gold Mines, Skagway, Haines, Sitka, Glacier, and Taku Galcier, Alaska. Round trip fares, from Seattle, Tacoma, Victoria, or Vancouver, $100 and upwards.

TRANSATLANTIC PASSENGER STEAMERS FROM NEW YORK.*

AMERICAN LINE.

Steamships.	Year	Gross Tonnage	Indic. H.-P.	Length
New York (Rebuilt 1903)	1888	10,798	16,000	576
St. Louis	1895	11,629	17,500	554
St. Paul	1895	11,629	17,000	554
Philadelphia	1899	10,786	16,800	576

ANCHOR LINE.

Columbia	1901	8,400	8,400	503
Caledonia	1904	9,400	10,200	515
California	1907	9,000	7,000	485
Cameronia	1910	10,500	12,000	532

ATLANTIC TRANSPORT LINE.

Minneapolis	1900	13,448	9,500	616
Minnehaha	1900	13,443	9,500	616
Minnetonka	1902	13,440	9,500	616
Minnewaska	1909	14,317	9,500	616

AUSTRO-AMERICAN LINE.

Laura	1907	6,122	4,500	415
Alice	1907	6,122	4,500	415
Argentina	1907	5,526	3,600	416
Oceania	1907	5,497	3,600	390
Martha Washington	1909	8,312	7,500	460
Kaiser Franz-Joseph I.	1912	12,567	13,000	500

COMPAÑIA TRANSATLANTICA.

Cadiz and Barcelona Service.)

Antonio Lopez	1891	6,300	5,000	430
Manuel Calvo	1892	6,000	6,000	419.8
Buenos Ayres	1887	5,500	4,800	410.6
Monte-Video	1889	5,500	5,000	410
Montserrat	1889	4,500	4,500	371

CUNARD LINE.

(Queenstown and Liverpool Service.)

Campania	1893	13,000	30,000	620
Mauretania	1907	32,000	70,000	790
Lusitania	1907	32,500	70,000	785
Caronia	1905	20,000	21,000	675
Carmania	1905	20,000	21,000	675
Franconia	1911	18,150	14,000	600
Laconia	1911	18,098	14,000	600
Aquitania (Building)	....	50,000	.....	885

CUNARD LINE.

(Mediterranean and Adriatic Service.)

Ultonia	1898	10,200	.....	500
Carpathia	1903	13,600	.....	540
Pannonia	1904	10,000	.....	501
Saxonia	1900	14,270	10,400	580
Ivernia	1900	14,210	10,400	580

*Tables copyright 1912 by Munn & Co., Inc.

TRANSATLANTIC PASSENGER STEAMERS FROM NEW YORK.—*Continued.*

FABRE LINE.

(Various points, including Naples, depending on season of year.)

Steamships.	Year.	Gross Tonnage	Indic. H.-P.	Length.
Roma	1902	5,291	6,000	426
Germania	1903	5,103	6,000	426
Madonna	1905	5,633	6,200	450
Venezia	1907	6,827	7,200	460
Sant' Anna	1910	9,350	10,000	500
Canada	1912	9,350	10,000	500

FRENCH LINE.

La Touraine	1890	9,161	12,000	536
La Lorraine	1899	11,874	22,000	580
La Savoie	1900	11,889	22,000	580
La Provence	1906	14,744	30,000	624
Chicago	1906	11,112	9,200	520
Rochambeau	1911	12,678	13,000	543
France	1912	23,666	40,000	720

HAMBURG-AMERICAN LINE.

Pennsylvania	1896	13,333	5,500	557.6
Patricia	1897	13,273	6,000	560
Pretoria	1898	13,234	5,400	560
Bulgaria*	1898	11,077	4,000	501.6
Graf Waldersee	1899	13,193	5,500	560
Batavia*	1899	11,464	4,000	501
Victoria Luise	1900	16,502	14,000	686.6
Hamburg*	1900	10,532	9,000	498
Bluecher	1901	12,334	9,500	525.6
Moltke*	1902	12,335	9,500	525
Amerika	1905	22,225	15,500	690
Kaiserin Auguste Victoria	1906	24,581	17,500	700
President Lincoln	1907	18,100	7,500	615
President Grant	1907	18,100	7,500	615
Cleveland	1908	18,000	9,300	600
Cincinnati	1908	18,000	9,300	600
Imperator (Building)	1913	50,000	.....	900

* Mediterranean Service.

HOLLAND-AMERICA LINE.

(Netherlands-American Steam Navigation Co.)

Potsdam	1900	12,600	7,500	560
Ryndam	1901	12,546	7,590	560
Noordam	1902	12,540	7,500	560
New Amsterdam	1906	17,250	10,000	615
Rotterdam	1908	24,170	14,000	668
(Building)	....	32,500	21,000	740

ITALIA LINE.

(Società di Navigazione a Vapore. Naples, Genoa, New York Service.)

Ancona	1908	10,000	7,600	520
Verona	1908	10,000	7,600	520

LA VELOCE LINE.

(Navigazione Italiana a Vapore.)

Oceania	1908/9	12,000	9,000	525
America	1909	12,000	9,000	525
Europa	1906	8,000	9,000	425

NAVIGAZIONE GENERALE ITALIANA LINE.

(Fiorio Rubattino).

Duca d'Aosta	1909	12,000	9,000	525
Duca di Genova	1908/9	12,000	9,000	525
Duca degli Abruzzi	1908	12,000	9,000	525

TRANSATLANTIC PASSENGER STEAMERS FROM NEW YORK—*Continued.*

LLOYD ITALIANO

Steamships.	Year.	Gross Tonnage.	Indic. H.-P.	Length.
Florida	1905	5,018	444	381.4
Luuisiana	1906	4,983	444	393.7
Indiana	1905	4,996	444	393.7
Virginia	1906	5,181	477	381.4
Cordova	1905	4,933	531	411.4
Mendoza	1905	6,847	851	420
Principessa Mafalda	1909	9,210	917	485

NORTH GERMAN LLOYD. (Bremen Service.)

Friedrich der Grosse	1896	10,568	7,200	546
Bremen	1896	11,570	8,000	569
Kaiser Wilhelm der Grosse	1897	14,349	28,000	649
Rhein	1899	10,058	5,500	520
Grosser Kurfürst	1900	13,245	9,700	582
Main	1900	10,067	5,500	520
Kronprinz Wilhelm	1901	14,908	35,000	663
Kaiser Wilhelm II	1903	19,500	43,000	707
Prinzess Alice	1904	10,911	9,000	524
Kronpr'n Cecilie	1907	20,000	45,000	707
Prinz Fr. Wilhelm	1908	17,500	14,000	613
George Washington	1909	25,570	20,000	723
Columbus	1914	40,000	25,000	800

NORTH GERMAN LLOYD. (Mediterranean Service.)

Koenigin Luise	1896	10,711	7,000	544
Barbarossa	1896	10,915	7,000	546
Koenig Albert	1899	10,643	9,000	525
Prinzess Irene	1900	10,881	9,000	525
Berlin	1908	19,200	16,500	613

RED STAR LINE

Vaderland	1900	11,960	10,000	580
Zeeland	1901	11,905	9,800	580
Finland	1902	12,188	9,300	577
Kroonland	1902	12,185	9,400	577
Lapland	1909	18,694	14,500	620

RUSSIAN-AMERICAN LINE.

Russia	1909	16,000	10,000	475
Kursk	1911	16,000	10,000	450
Czar	1912	16,000	10,000	425

SCANDINAVIAN-AMERICAN LINE.

C. F. Tietgen	1897	8,500	5,500	485
Oscar II	1901	10,600	8,000	515
Hellig Olav	1902	10,000	8,000	515
United States	1903	10,000	8,000	515
Frederick VIII. (Building)	1912	12,000	10,000	540

WHITE STAR LINE.

Majestic	1890	10,147	16,000	582
Oceanic	1899	17,274	28,000	705
Canopic	1900	12,097	8,730	594
Celtic	1901	20,904	14,000	697
Cedric	1902	21,035	14,000	697
Baltic	1904	23,876	15,000	726
Adriatic	1907	24,541	17,000	726
Laurentic	1909	14,892	14,000	565
Megantic	1909	14,878	11,000	565
Olympic	1911	45,324	.....	882

TRANSATLANTIC PASSENGER STEAMERS FROM PORTS OTHER THAN NEW YORK.

CUNARD LINE.
(Boston-Liverpool Service.)

Steamships.	Year	Gross Tonnage.	Indic. H.-P.	Length.
Franconia	1911	18,098	14,000	600
Laconia	1912	18,149	14,000	600

ALLAN LINE.

Parisian	1881	5,395	774	440
Numidian	1891	4,836	582	400
Mongolian	1891	4,838	582	400
Carthaginian	1884	4,444	475	386
Siberian	1884	3,846	463	372
Hungarian	1902	4,508	446	388
Hibernian	1902	4,505	446	385
Ontarian	1900	4,309	359	385
Orcadian	1893	3,546	328	361

LEYLAND LINE.

Devonian	1900	10,435	4,702	571
Winifredian	1899	10,422	4,505	571
Canadian	1900	9,309	4,120	549
Bohemian	1900	8,555	4,019	529
Cestrian	1896	8,912	3,529	529

WHITE STAR LINE.

Cymric	1898	13,096	7,700	599
Cretic	1902	13,518	7,300	601
Arabic	1903	15,801	9,200	615.6

WHITE STAR LINE.
(Australian Service.)

Gothic	1893	7,758	4,460	504
Belgre	1903	9,767	4,000	505

NORTH GERMAN LLOYD S. S. CO.
(Baltimore-Bremen Service.)

Rhein	1899	10,058	5,500	520
Breslau	1901	7,524	3,400	428
Neckar	1901	9,835	6,000	520
Main	1900	10,058	5,500	520
Oldenburg	....	5,002	3,600	428
Cassel	1901	7,553	3,400	428

NORTH GERMAN LLOYD S. S. CO.
(Galveston-Bremen Service.)

Chemnitz	1901	3,200	7,542	430
Frankfurt	1899	3,200	7,431	431

ALLAN LINE.
(Montreal Services.)

Victorian	1904	10,629	....	520
Virginian	1905	10,754	....	520
Tunisian	1900	10,576	849	500
Corsican	1907	11,419	917	500
Hesperian	1908	10,920	303	485
Grampian	1907	10,947	825	485
Ionian	1901	8 268	604	470
Pretorian	1901	6,508	800	436
Corinthian	1899	6,220	447	430
Sicilian	1899	6,229	447	430
Sardinian	1875	4,349	316	400
Pomeranian	1882	4,207	550	381
Alsatian (Building)	1913	17,000	18,000	560
Albynian (Building)	1913	17,000	18,000	560

TRANSATLANTIC PASSENGER STEAMERS FROM PORTS OTHER THAN NEW YORK—*Continued.*

CANADIAN PACIFIC RAILWAY CO.

Steamships.	Year.	Gross Tonnage.	Indic. H.-P.	Length.
Empress of Britain	1906	14,500	3,168	548.8
Empress of Ireland	1906	14,500	3,168	548.9

Royal Mail Steamers "Empress of Britain" and "Empress of Ireland" leave Quebec in Summer and St. John in Winter. Other vessels of the line carry second only, second and steerage only, and steerage only. Their names are therefore omitted here.

WHITE STAR–DOMINION.

Laurentic	1909	14,892	.....	484
Megantic	1909	15,000	.....	550
Canada	1896	9,413	6,641	514
Dominion	1894	7,036	3,514	456
Teutonic	1889	9,984	16,000	582

DONALDSON LINE.
(Montreal to Glasgow.)

Athenia	1904	8,668	5,600	478
Cassandra	1906	8,135	5,555	455
Saturnia	Building	.....	.....	....

MONTREAL SERVICES—THOMSON LINE.
(Mediterranean Service.)

Tortona	1909	7,907	5,400	450.6

PHILADELPHIA STEAMSHIP SERVICES—AMERICAN LINE.

Haverford	1901	11,635	4,157	547
Merion	1902	11,621	3,953	547

RED STAR LINE.

Marquette	1898	7,058	3,700	502
Menominee	1897	6,918	3,700	490
Manitou	1898	6,848	3,700	490

CUNARD LINE.
(Montreal—London.)

Ascania	1911	9,111	.....	482
Ansonia	1909	7,907	.....	465

FRENCH LINE.
(Quebec—Havre Service.)

Niagara	1908	9,614	8,250	504
Floride	1908	7,029	3,400	437
Caroline	1908	7,220	4,200	437

(New Orleans—Havre Service.)

Louisiane	1908	5,399	3,000	403
Californie	1905	5,455	3,000	417
Virginie	1907	5,579	2,300	409
Mexico	1907	5,276	3,000	409

These tables include the principal lines engaged in European trade. There are other lines, however, carrying passengers, but which are omitted on account of infrequent or irregular services, or failure to respond to copies of proof sheets sent out for correction. The Editor takes no responsibility for the list as printed, though more than ordinary care has been used in its compilation and correction. It should also be borne in mind that "Lowest Ocean Rates" means only the lowest fares at any season of the year. During the rush or "high" season these fares usually apply only to a very few inside rooms, and plans should not be based on this schedule without consulting the steamship company or a reputable tourist agency to find if any minimum accommodations are available. In the fall and winter seasons superior rooms can usually be obtained at minimum rates without difficulty. If you live out of town do not wait until reaching New York, Boston or Philadelphia before attempting to secure passage. If you are going in July engage your passage in January if possible. There will be little difficulty in canceling accommodations if plans have to be changed.

RATES TO EUROPEAN PORTS FROM CANADA.*

Allan Line.

MONTREAL AND QUEBEC TO LIVERPOOL.

First class passage from St. John or Halifax, $72.50 and up; Montreal or Quebec and Liverpool, $80.00 and up. Second class, $50.00 and up.

MONTREAL TO GLASGOW.

First class, $70.00 and up; second class, $50.00 and up. One class cabin, $47.50 and up.

Canadian Pacific Railway Co.

MONTREAL AND QUEBEC TO LIVERPOOL.

First class, $92.50 from Quebec; $85.00 from St. John, and upwards; second class, $53.75 and up. One class cabin (second class) $50.00 and up.

Cunard Line.

MONTREAL TO LONDON AND SOUTHAMPTON TO MONTREAL.

Cabin (called second), $46.25 and up.

Donaldson Line.

MONTREAL TO GLASGOW.

Cabin (called second), $47.50 and up. British third class, East, $31.25; prepaid West, $31.25.

White Star—Dominion Line.

MONTREAL AND QUEBEC TO LIVERPOOL.

First class, summer season, $92.50 and up; winter season, $85.00 and up; second class, $53.75 and up. One class cabin, $47.50 and up.

RATES TO WEST INDIAN, SOUTH AMERICAN PORTS, ETC.†

The Booth Steamship Co., Ltd.

NEW YORK AND PARA, MANAOS, VIA BARBADOS.

	—Saloon— Single	Return	Third Class
Barbados	$50	$90	$25
Para	80	140	45
Manaos	100	175	50
Iquitos, Peru	140	245	75

Canadian South African Line.

MONTREAL OR ST. JOHN, N. B., TO CAPE TOWN, PORT ELIZABETH, EAST LONDON, DURBAN, AND DELAGOA BAY.

First class—Cape Town, $110. Durban. $135.

Compañia Transatlantica.

NEW YORK, HAVANA, VERA CRUZ AND PUERTO MEXICO

	To Havana	To Vera Cruz	To Puerto Mexico
First class	$37	$60	$60
Second class	26	40	40

Round trip 25 per cent. discount.

Hamburg-American Line—Atlas Service.

NEW YORK TO COLON AND WEST INDIAN PORTS.

	—1st Class— One way	Round trip	—2d Class— One way	Round trip
Kingston or Santiago	Oct. 1 to May 31 $45 00	$85 50	$30 00	$57 00
Colon	75 00	142 50	45 00	85 50
Puerto Colombia	80 00	152 00	45 00	85 50
Cartagena	80 00	152 00	45 00	85 50
Santa Marta	80 00	152 00	45 00	85 50
Port-Limon	80 00	152 50	45 00	85 50
Port au Prince	60 00	100 00	35 00	60 00
Jeremie	60 00			
Kingston } Santiago }	$75, round trip			
Colon	$115 "			

Elder, Dempster Line.

MONTREAL TO NASSAU, HAVANA AND MEXICAN PORTS.

Nassau	$35	Havana	$ 40
Tampico	60	—return	105
Vera Cruz	60	—return	105
Mexico City	65	—return	115
Progreso	60	—return	115

Insular Line, Inc.

NEW YORK AND PORTO RICO.

Rates of Passage. First class—To or from New York and Porto Rico, $35 and $40.

Lamport & Holt Line.

Direct service from New York to Brazil and Argentine. Steamers call at Bahia, Rio de Janeiro and Santos. Through tickets issued to Paranagua, Rio Grande do Sul, Montevideo, Buenos Ayres. All vessels call at Barbados and Trinidad northbound.

	Minimum 1st Class	—Intermediate— "V" Steamers	S.S. Byron and Tennyson	3d Class
Bahia	$150	$75	$60	$45
Rio de Janeiro	150	75	60	45
Santos	165	80	65	50
Paranagua	165	92	77	62
Rio Grande do Sul	180	95	80	65
Porto Alegre	185	97	82	67
Montevideo	190	90		60
Buenos Ayres	190	90		60
Rosario	200	93		65

Children under 12 years of age, half fare; under two years, free. Servants in saloon, two-thirds fare.

* † All rates are subject to change without notice, and any tourist agent will give accurate figures as to cost. On Aug. 1, 1912, the rates quoted as printed were believed to be correct.

RATES TO WEST INDIAN AND SOUTH AMERICAN PORTS—Continued.

Munson Steamship Line.

NEW YORK AND CUBA.

First Cabin.	One way.	Round trip.
New York to Nipe	$30.00	
New York and Nuevitas	30.00	$57.00
New York and Puerto Padre	45.00	.....
New York and Gibara	45.00	85.50
New York and Banes	45.00	.....
INTERMEDIATE.		
New York to Nipe	$22.00	
New York to Nuevitas	22.00	$41.80
New York to Puerto Padre	30.00	.....
New York to Gibara	30.00	.....

New York & Cuba Mail S.S. Co.

(WARD LINE.)

NEW YORK-HAVANA-MEXICO SERVICE.

To	1st Class.
Havana	$35.00 and up
Progreso	50.00
Mexico City	62.20
Vera Cruz	55.00

Children under 3 years, not exceeding one to a family free; each additional child half fare.

Children 8 to 12, accompanied by an adult, half fare.

NASSAU.

To	1st Class	2d Class
Nassau	$40.00	$15.00

New York & Porto Rico S.S. Co.

NEW YORK AND SAN JUAN, PONCE AND MAYAGUEZ, PORTO RICO.

First class $45 and up. Excursion $81 and up. Second class $25 and up.

Panama Railroad Steamship Line.

COLON—CANAL ZONE—PANAMA, SAN FRANCISCO, MEXICO, CENTRAL AND SOUTH AMERICA.

New York to Canal Zone (Colon)	$75.00
New York to San Francisco	120.00

Peninsular and Occidental S.S. Company.

KEY WEST, CUBA AND THE WEST INDIES, PORT TAMPA—KEY WEST—HAVANA LINE.

Between	One Way.	Round Trip.
Port Tampa and Havana	$25.40	$42.10
Key West and Port Tampa	12.90	21.10
Key West and Havana	12.50	21.00

The above rates include meals and berth while at sea.

Southern Pacific Steamers.

NEW ORLEANS AND HAVANA SERVICE.

Fares between New Orleans and Havana.

First cabin	$25.00
Round trip, either direction	45.00
Steerage	12.50

Trinidad Line.

NEW YORK, GRENADA AND TRINIDAD, B.W.I.

Trinidad or Grenada—first class	$50.00
Trinidad or Grenada—excursion	90.00

Quebec S.S. Co., Ltd.

NEW YORK TO BERMUDA AND WINDWARD ISLANDS.

Bermuda Service.

Cabin passage, round trip, $25 and up, according to steamer and date of sailing. (Subject to change.) Steerage passage, $15; excursion, $18. Alien Tax $4 additional.

West India Service.

New York to St. Thomas, St. Croix, St. Kitts, Antigua, Guadeloupe, Dominica, Martinique, St. Lucia, Barbados and Demerara.

Cabin passage, $45 to $75. Return tickets, good for 6 months, $90 to $150. Steerage $25 to $30. U. S. Alien Tax $4 additional.

Red "D" Line.

TO PUERTO RICO AND VENEZUELA, NEW YORK TO LA GUAYRA, PUERTO CABELLO, CURACAO AND MARACAIBO.

S.S. "CARACAS" AND "PHILADELPHIA"

	1st Class Upper Deck	1st Class Saloon Deck	3d Class
New York and San Juan	$40.00	$35.00	$20.00
New York and La Guayra by most direct route	65.00	60.00	30.00
New York and Curacao	65.00	60.00	30.00
New York to Puerto Cabello	70.00	65.00	35.00
La Guayra and New York (via Puerto Cabello)	75.00	70.00	40.00
Puerto Cabello to New York	65.00	60.00	30.00

S.S. "ZULIA" AND S.S. "MARACAIBO"

	1st Class	2d Class
New York and Mayaguez	$35.00	$25.00
New York to La Guayra	60.00	40.00
New York and Curacao	60.00	40.00
New York and Maracaibo	75.00	50.00

No second class passengers carried on the S.S. "Caracas," "Philadelphia," or "Merida."

Round trip 10 per cent. reduction. Good for 12 months.

The Royal Mail Steam Packet Company.

NEW YORK AND SOUTHAMPTON VIA CUBA, JAMAICA, COLON, CARTAGENA, PUERTO COLOMBIA (SAVANILLA), TRINIDAD (TRANSFER HERE FOR VENEZUELA, BRITISH GUIANA AND WINDWARD AND LEEWARD ISLANDS), BARBADOS, ST. MICHAELS (AZORES) AND CHERBOURG, RETURNING TO NEW YORK BY SAME ROUTE REVERSED.

New York to	First Class Single	First Class Return	Second Class Single	Second Class Return
Antilla (Cuba)	$42.50	$80.75	$30.00	$57.00
Kingston	45.00	85.50	30.00	57.00
Colon	75.00	142.50	45.00	85.50
Cartagena	80.00	152.00	45.00	85.50
Puerto Colombia (Savanilla)	80.00	152.00	45.00	85.50
Trinidad	85.00	153.00	55.00	99.00
Barbados	90.00	162.00	60.00	108.00
Cherbourg	175.00	300.00	125.00	200.00
Southampton	200.00	350.00		

CUBA.

Santiago and Camaguey, $45 first class, $30 second class; Havana, $55 first class; Havana via Santiago, $58.50 first class.

BERMUDA SERVICE

New York to Bermuda, first class, round trip, $25 and up.

RATES TO WEST INDIAN AND SOUTH AMERICAN PORTS—Continued.

UNITED FRUIT COMPANY.

NEW YORK—JAMAICA—PANAMA—COSTA RICA AND COLOMBIA SERVICES.

Per Adult Between New York and	First Cabin. One Way.	Round Trip.
Kingston	$45.00	$85.50
Colon	75.00	142.50
Cartagena	80.00	152.00
Puerto Colombia	80.00	152.00
Santa Marta	80.00	152.00
Limon	80.00	152.00

BETWEEN PHILADELPHIA AND PORT ANTONIO, JAMAICA.

	One Way.	Round Trip.
First cabin	$40.00	$76.00
Second Cabin With meals at second table	30.00	57.00

BOSTON—COSTA RICA SERVICE.

Fare, Boston to Limon, one way, $60.00; round trip, $114.00.

NEW ORLEANS—GUATEMALA—COSTA RICA—PANAMA SERVICE.

	One Way Cabin 1st Class	Round Trip Cabin 1st Class
Between New Orleans and Belize, British Honduras	$25.00	$45.00
Between New Orleans and Livingston, Guatemala	30.00	37.00
Between New Orleans and Barrios, Guatemala	30.00	57.00
Between New Orleans and Cortez, Spanish Honduras	30.00	57.00
Between New Orleans and Limon, Costa Rica	50.00	95.00
Between New Orleans or Mobile and Bocas del Toro, Panama	50.00	95.00
Between New Orleans and Colon, Panama	50.00	95.00

RATES TO PACIFIC AND TRANS-PACIFIC PORTS.

CANADIAN-AUSTRALIAN ROYAL MAIL LINE.

From VANCOUVER, B. C., To	ONE-WAY FARES. First Cabin.	Servants Accompanying Families.	Second Cabin.	Steerage.	ROUND-TRIP FARES. First Cabin. Four Months.	First Cabin. Twelve Months.	Second Cabin. Twelve Months.
HONOLULU, Hawaiian Islands	$75.00	$50.00	$50.00	$30.00	$135.00	.....	$100.00
SUVA, Fiji Islands	200.00	133.50	125.00	80.00	.....	$300.00	200.00
AUCKLAND, New Zealand	200.00	133.50	125.00	80.00	.....	300.00	200.00
SYDNEY, New South Wales	200.00	133.50	125.00	80.00	.....	300.00	200.00
BRISBANE, Queensland, via Sydney and rail	212.90	146.40	133.55	88.55	.....	319.50	212.90
" " via Sydney and steamer	213.85	147.35	138.85	85.15	.....	323.00	223.00
ROCKHAMPTON, Queensland, via Sydney and steamer	224.25	157.75	149.25	91.60	.....	341.40	241.40
MELBOURNE, Victoria, via Sydney and rail	213.15	146.65	134.65	89.75	.....	319.50	214.60
" " via Sydney and Intercolonial steamer	211.50	145.00	136.50	85.15	.....	318.45	218.45
ADELAIDE, South Australia, via Sydney and rail	219.50	153.00	137.80	92.80	.....	329.20	219.50
" " via Sydney and Intercolonial steamer	220.70	154.20	145.70	90.25	.....	332.20	232.20
FREMANTLE, West Australia, via Sydney and Intercolonial steamer	246.00	179.50	171.00	105.55	.....	369.00	269.00
ALBANY, West Australia, via Sydney and Intercolonial steamer	246.00	179.50	171.00	105.55	.....	369.00	269.00
HOBART, Tasmania, via Sydney and steamer	212.05	145.55	136.55	87.30	.....	319.30	219.30
APIA, Samoan Islands, via Suva and steamer	200.00	133.50	125.00	80.00	.....	300.00	200.00
WELLINGTON, New Zealand, via Auckland and steamer	213.80	147.30	138.80	89.25	.....	323.00	223.00
PORT LYTTLETON (Christ Church), New Zealand, via Auckland and steamer	218.45	151.85	143.45	91.55	.....	330.15	230.15
DUNEDIN, New Zealand, via Auckland and steamer	223.00	156.50	148.00	93.85	.....	337.25	237.25

UNION STEAMSHIP CO. OF NEW ZEALAND. (Ltd.)

From SAN FRANCISCO, CAL., To	ONE-WAY FARES. First Cabin.	Second Cabin.	Third Cabin.	ROUND-TRIP FARES. First Cabin. Four Months.	Second Cabin. Four Months.
PAPEETE, Tahiti	$120.00	$80.00	$40.00	$195.00	$110.00
RAROTONGA, Cook Islands	122.50	78.75	53.75	175.00	142.50
APIA, Samoan Islands, via Auckland and steamer	247.00	@138.50	107.00	398.75	@318.75
SUVA, Fiji Islands, via Auckland and steamer	237.00	@179.50	96.00	378.75	@298.75
AUCKLAND, New Zealand, via Wellington	194.50	137.00	75.00	293.75	213.75
WELLINGTON, New Zealand	178.75	121.25	75.00	287.50	187.50
PORT LYTTLETON, (Christ Church), New Zealand, via Wellington	184.00	126.50	78.50	276.75	196.75
DUNEDIN, New Zealand, via Wellington	189.25	131.75	82.00	285.00	205.00
HOBART, Tasmania, via Wellington	213.75	138.75	88.25	323.00	222.00
SYDNEY, New South Wales, via Wellington and steamer	200.00	125.00	80.00	300.00	200.00
BRISBANE, Queensland, via Sydney and rail	213.25	133.75	88.75	319.50	213.00
MELBOURNE, Victoria, via Sydney and rail	213.25	134.75	90.00	319.50	214.75
ADELAIDE, South Australia, via Sydney and rail	219.50	137.75	92.75	329.25	219.50
FREMANTLE, West Australia, via Sydney and rail	255.00	180.00	107.50	382.75	263.00

@First cabin on steamship beyond Auckland, New Zealand.

RATES TO PACIFIC AND TRANS-PACIFIC PORTS—Continued.

NIPPON YUSEN KAISHA (Japan Mail Steamship Co.)

From SEATTLE, WASH., To	ONE-WAY FARES. First Cabin.	Servants Accompanying Families: Other than Asiatic.	Servants Accompanying Families: Asiatic.	Second Cabin.	Intermediate.	Asiatic Steerage.	ROUND-TRIP FARES. First Cabin: Four Months.	First Cabin: Twelve Months.	Servants Accompanying Families: Other than Asiatic: Four Months.	Servants Accompanying Families: Other than Asiatic: Twelve Months.	Servants Accompanying Families: Asiatic.	Second Cabin: Four Months.	Second Cabin: Twelve Months.
YOKOHAMA, Japan	$125.00	$85.00	$42.50	(a)$85.00	(a)	$43.50	$187.50	$220.00	$127.50	$150.00	$85.00	(a)$127.50	(a)$150.00
KOBE, Japan	127.50	87.50	42.50	(a) 87.50	(a)	43.50	192.50	225.00	132.50	152.50	85.00	(a) 132.50	(a) 152.50
MOJI, Japan	130.00	90.00	42.50	(a) 90.00	(a)	43.50	195.00	227.50	135.00	157.50	85.00	(a) 135.00	(a) 157.50
NAGASAKI, Japan, via Kobe	137.50	95.00	42.50	(a) 92.50	(a)	43.50	207.50	240.00	145.00	167.50	85.00	(a) 142.50	(a) 162.50
SHANGHAI, China	140.00	100.00	42.50	(a)100.00	(a)	43.50	210.00	245.00	150.00	175.00	85.00	(a) 150.00	(a) 175.00
HONG KONG	150.00	105.00	42.50	(a)105.00	(a)	43.50	225.00	262.50	157.50	185.00	85.00	(a) 157.50	(a) 185.00
MANILA, Philippine Islands	150.00	105.00	42.50	(a)105.00	(a)	43.50	225.00	262.50	157.50	185.00	85.00	(a) 157.50	(a) 185.00

(a) Fares will *not* apply via steamships *Yokohama Maru* and *Shidzuoka Maru*.
(b) Canceled; no fare in effect.

BANK LINE (Ltd.)

From SEATTLE OR TACOMA, WASH., OR VANCOUVER, B. C., To	ONE-WAY FARES. First Cabin.	Servants Accompanying Families. Other than Asiatic.	Servants Accompanying Families. Asiatic.	Asiatic Steerage.	ROUND-TRIP FARES. First Cabin: Four Months.	First Cabin: Twelve Months.	Servants Accompanying Families. Other than Asiatic: Four Months.	Servants Accompanying Families. Other than Asiatic: Twelve Months.	Servants Accompanying Families. Asiatic.
YOKOHAMA, Japan	$100.00	$85.00	$42.50	$43.50	$150.00	$175.00	$127.50	$150.00	$85.00
KOBE, Japan	104.00	87.50	42.50	43.50	156.00	182.00	132.50	152.50	85.00
MOJI, Japan	106.50	90.00	42.50	43.50	159.75	188.40	135.00	157.50	85.00
NAGASAKI, Japan, via Kobe	110.00	95.00	42.50	43.50	165.00	192.50	145.00	167.50	85.00
SHANGHAI, China	115.00	100.00	42.50	47.50	172.50	201.25	150.00	175.00	85.00
HONG KONG	115.00	105.00	42.50	47.50	172.50	201.25	157.50	185.00	85.00
MANILA, Philippine Islands	115.00	105.00	42.50	47.50	172.50	201.25	157.50	185.00	85.00

OCEAN STEAMSHIP CO. (Ltd.) AND CHINA MUTUAL STEAM NAVIGATION CO. (Ltd.)

From SEATTLE OR TACOMA, WASH., OR VANCOUVER, B. C., To	ONE-WAY FARES. Asiatic Steerage.
YOKOHAMA, Japan	$43.50
KOBE, Japan	43.50
MOJI, Japan	43.50
NAGASAKI, Japan	43.50
SHANGHAI, China	51.00
HONG KONG	51.00
MANILA, Philippine Islands	51.00

CANADIAN PACIFIC RY. CO.'S ROYAL MAIL STEAMSHIP LINE.

From VANCOUVER, B. C., To	ONE-WAY FARES. First Cabin.	Servants Accompanying Families. Other Than Asiatic.	Servants Accompanying Families. Asiatic.	Intermediate.	Asiatic Second Class.	Asiatic Steerage.		ROUND-TRIP FARES. First Cabin: Four Months.	First Cabin: Twelve Months.	Servants Accompanying Families. Other than Asiatic: Four Months.	Servants Accompanying Families. Other than Asiatic: Twelve Months.	Servants Accompanying Families. Asiatic.
YOKOHAMA, Japan	(a)$200.00	$133.35	$50.00	(a)$100.00	(a)$70.00	(a)$51.00	(a)$43.50	(a)$300.00	(a)$350.00	$200.00	$233.35	$100.00
KOBE, Japan	(a)207.50	138.35	50.00	(a)104.00	(a) 74.00	(a) 51.00	(a) 43.50	(a) 312.50	(a) 365.00	208.35	243.35	100.00
MOJI, Japan	.....	.....	.....	(a)110.00	(a) 80.00	.....	(a) 43.50	.....	.....	.....	.....	.....
NAGASAKI, Japan	(a)222.50	(a)148.35	(a)50.00	(a)	(a) 80.00	(a) 51.00	(a)	(a)334.00	(a)393.75	(a)222.70	(a)262.50	(a)100.00
SHANGHAI, China	(a)225.00	150.00	50.00	(a)115.00	(a) 85.00	(a) 51.00	(a) 51.00	(a)337.50	(a)393.75	225.00	262.50	100.00
HONG KONG	(a)225.00	150.00	50.00	(a)115.00	(a) 85.00	(a) 51.00	(a) 51.00	(a)337.50	(a)393.75	225.00	262.50	100.00
MANILA, Philippine Islands via Hong Kong	(a)225.00	150.00	50.00	(a)115.00	(a) 85.00	(a) 51.00	(a) 51.00	(a)337.50	(a)393.75	225.00	262.50	100.00

(a) Fares apply only via steamships *Empress of Japan* and *Empress of India*.
(b) Fares apply only via steamship *Monteagle*.
(c) Fares apply only via steamships *Empress of Japan*, *Empress of India*, and *Monteagle*.
(d) Canceled; no fare in effect.

RATES TO PACIFIC AND TRANS-PACIFIC PORTS—Continued.

MATSON NAVIGATION CO.

From SAN FRANCISCO, CAL., To	ONE-WAY FARES. First Cabin.	Servants Accompanying Families.	Steerage.	ROUND-TRIP FARES. First Cabin. Four Months.
HONOLULU, Hawaiian Islands	$85.00	$50.00	$30.00	$110.00

GREAT NORTHERN STEAMSHIP CO.

From SEATTLE, WASH., To	ONE-WAY FARES. First Cabin.	Servants Accompanying Families. Other than Asiatic.	Servants Accompanying Families. Asiatic.	Second Cabin.	Third Cabin.	Asiatic Steerage	ROUND-TRIP FARES. First Cabin. Four Months.	First Cabin. Twelve Months.	Servants Accompanying Families. Other than Asiatic. Four Months.	Servants Accompanying Families. Other than Asiatic. Twelve Months.	Servants Accompanying Families. Asiatic. Twelve Months.	Second Cabin. Four Months.
YOKOHAMA, Japan	$200.00	$133.35	$50.00	$100.00	$70.00	$51.00	$300.00	$350.00	$200.00	$233.35	$100.00	$200.00
KOBE, Japan	207.50	138.35	50.00	104.00	74.00	51.00	312.50	365.00	208.35	243.35	100.00	208.00
NAGASAKI, Japan	222.50	148.35	50.00	110.00	80.00	51.00	334.00	393.75	222.70	262.50	100.00	220.00
SHANGHAI, China	225.00	150.00	50.00	115.00	85.00	51.00	337.50	393.75	225.00	262.50	100.00	230.00
HONG KONG	225.00	150.00	50.00	115.00	85.00	51.00	337.50	393.75	225.00	262.50	100.00	230.00
MANILA, Philippine Islands, via Hong Kong	225.00	150.00	50.00	115.00	85.00	51.00	337.50	393.75	225.00	262.50	100.00	230.00

PACIFIC MAIL STEAMSHIP CO. OR TOYO KISEN KAISHA.

From SAN FRANCISCO, CAL., To	ONE-WAY FARES. First Cabin	Servants Accompanying Families. Other Than Asiatic.	Servants Accompanying Families. Asiatic.	Intermediate	Second Class.	Asiatic Steerage	ROUND-TRIP FARES. First Cabin. Four Months	First Cabin. Twelve Months.	Servants Accompanying Families. Other than Asiatic. Four Months.	Servants Accompanying Families. Other than Asiatic. Twelve Months.	Servants Accompanying Families. Asiatic. Four Months or Twelve Months.
HONOLULU, Hawaiian Islands, via Pacific Mail Steamship Co. only	(a)$75.00	(a)$50.00	(a)$30.00	(b)$65.00	(b)$30.00	(a)$30.00	(a)$135.00 (a)110.00		(a)$90.00		(a)$60.00
(c)YOKOHAMA, Japan	200.00	133.35	50.00	(a)100.00	70.00	51.00	300.00	$350.00	200.00	$233.35	100.00
(c)KOBE, Japan	207.50	138.35	50.00	(a)104.00	74.00	51.00	312.50	365.00	208.35	243.35	100.00
(c)NAGASAKI, Japan	222.50	148.35	50.00	(a)110.00	80.00	51.00	334.00	393.75	222.70	262.50	100.00
(c)SHANGHAI, China	225.00	150.00	50.00	(a)115.00	85.00	51.00	337.50	393.75	225.00	262.50	100.00
(c)HONG KONG	225.00	150.00	50.00	(a)115.00	85.00	51.00	337.50	393.75	225.00	262.50	100.00
(c)MANILA, Philippine Islands, via Nagasaki direct or Hong Kong	225.00	150.00	50.00	(a)115.00	85.00	51.00	337.50	393.75	225.00	262.50	100.00

(a)**In constructing through fares via San Francisco and the Pacific Mail Steamship Co. or Toyo Kisen Kaisha,** the following deductions will be made from the one-way and round-trip basing fares of the Steamship lines named to all points, **except Honolulu,** as shown above:

Deduct $2.85 when one-way first-class railway tickets and $2.20 when excursion railway tickets are issued from New York or Philadelphia to San Francisco.
Deduct $1.75 when one-way mixed-class railway tickets are issued from New York or Philadelphia to San Francisco.
Deduct $1.35 when one-way first-class railway tickets and $1.45 when excursion railway tickets are issued from Baltimore or Washington to San Francisco.
Deduct 25 cents when one-way mixed-class railway tickets are issued from Baltimore or Washington to San Francisco.

No deductions will be made on variable route excursion railway tickets to San Francisco in one direction either going or returning via Portland, Seattle, Tacoma, Vancouver, or Victoria.

(a)Fares will *not* apply via Steamships *Persia* and *Nile* of Pacific Mail Steamship Co.
(b)Fares apply only via Steamship *China.*
(c)Fares apply only via steamships *China, Persia,* and *Nile* of Pacific Mail Steamship Co., and *Nippon Maru* of Toyo Kisen Kaisha.
(d)Fares apply only via steamship *China* with intermediate accommodations.

OCEANIC STEAMSHIP CO.

From SAN FRANCISCO, CAL., To	ONE-WAY FARES. First Cabin.	Second Cabin.	Third Cabin	ROUND-TRIP FARES. First Cabin. Four Months.	Second Cabin Four Months
HONOLULU, Hawaiian Islands	$85.00	....	(b)$30.00	$110.00	.....
PAPEETE, Tahiti	(c)	(c)	(c)	(c)	.....
PAGO PAGO, Samoan Islands	160.00	$110.00	(b) 80.00	240.00	$165.00
SYDNEY, New South Wales	200.00	125.00	(b) 80.00	300.00	200.00
BRISBANE, Queensland, via Sydney and rail	213.00	133.75	(b) 88.75	319.50	213.00
MELBOURNE, Victoria, via Sydney and rail	213.25	134.75	(b) 89.75	319.50	214.75
AUCKLAND, New Zealand, via Sydney and steamer	213.25	138.25	(b) 97.75	319.75	219.75
WELLINGTON, New Zealand, via Sydney and steamer	213.25	138.25	(b) 97.75	319.75	219.75
ADELAIDE, South Australia, via Sydney and rail	219.50	127.75	(b)102.75	329.25	219.50
FREMANTLE, West Australia, via Sydney and steamer	244.00	169.00	(b)114.50	365.75	285.75
HOBART, Tasmania, via Sydney and steamer	211.75	(b)136.00	(b) 96.50	317.50	217.50
PORT LYTTLETON (Christ Church), New Zealand, via Sydney and steamer	217.50	(b)142.50	(b)101.00	326.50	226.50
DUNEDIN, New Zealand, via Sydney and steamer	223.00	(b)147.00	(b)103.25	335.00	235.00

(a)First cabin on Intercolonial steamer beyond Sydney, New South Wales.
(b)Fares will *not* apply for females on steamships *Sonoma* and *Ventura.*
(c)Canceled; no fare in effect.

FROM STEAM PACKET TO STEAM PALACE.

(1) Wood Paddle-boats. (3) Iron Screw Steamers. (5) Steel Twin-Screw Steamers.
(2) Iron " (4) Steel " "

Date	Name of Steamer.	Owners.	Remarks.
1833	Royal William. . .(1)	Quebec & HalifaxS.N.Co.	From Pictou (N.S.), 1st to cross the Atlantic.
1838	Sirius.	British and Amer.S.N.Co.	From Cork, 1st departure from U. K.
"	Great Western.	Great Western S.N.Co.	" Bristol, 1st built for Atlantic.
"	Royal William.....(2)	Transatlantic SS. Co.	" Liverpool, 1st departure.
1840	Britannia.	Cunard Line	" Liverpool,1st carriedBritish mails.
1849	Atlantic.	Collins "	" New York, 1st carried U.S. mails.
1854	Canadian.	Allan "	" Glasgow, 1st steamer of Line.
1856	Tempest.	Anchor "	" " 1st " "
"	Borussia.	Hamburg-American Line	" Hamburg,1st " "
"	Adriatic.	Collins Line.	Last Sailing of Line.
1858	Bremen.	Norddeutscher Lloyd.	From Bremen to New York.
1856	Persia .....(2)	Cunard.	1st Cunard iron paddle steamer.
1862	Scotia.	"	Last " " " "
1845	Great Britain. . .(3)	Great Western S.N.Co.	1st Atlantic iron screw steamer.
1850	City of Glasgow.	Inman Line.	1st to carry steerage passengers.
1858	GREAT EASTERN.		Paddle wheels and propeller.
1868	Italy.	National Line.	1st Atlantic ss. with comp. engines.
1869	City of Brussels.	Inman "	1st " " " " steam steering gear.
1871	Oceanic (1st).	White Star Line	1st with midship saloon, &c.
1873	Pennsylvania.	American "	1st sailing of Line to Liverpool.
1874	Britannic.	White Star "	1st to exceed 5,000 tons, Great Eastern
1875	City of Berlin.	Inman "	1st with electric light. [excepted.
1879	Arizona.	Guion. "	Watertight compartments floated her.
1882	Alaska.	"	1st "ocean greyhound."
1883	Oregon.	" (1) / Cunard " (2)	Sunk outside New York; every one saved by N. D. Lloyd ss. Fulda.
1879	Buenos Ayrean. . (4)	Allan Line.	1st Atlantic steel steamer.
1881	Servia.	Cunard "	1st Cunard " "
"	City of Rome.	Inman (1) Line / Anchor(2) "	Fitted with three funnels.
1884	America.	National "	1st and last express ss. of Line.
"	Umbria. / Etruria.	Cunard "	1st with 20 knots speed.
1886	Aller.	Norddeutscher Lloyd.	1st triple-expansion express ss.
1888	City of NewYork(5) / City of Paris.	Inman & International(1) / American Line (2)	1st twin-screw ocean expresses. 1st to exceed 10,000 tons,G.E.excepted
1889	Teutonic. / Majestic.	White Star Line.	Designed as mercantile cruisers.
1890	Fürst Bismarck.	Hamburg-American Line	1st under 6½ days from Southampton.
1892	La Touraine.	Compagnie Générale Trans.	Record Havre to New York, 6¾ days.
1893	Campania. / Lucania.	Cunard Line.	Lucania: highest day's run 562 knots. Liverpool to New York records.
1895	St. Paul. / St. Louis.	American.	Largest express steamers ever built in America.
1897	KaiserWilhelm d.Gr.	Norddeutscher Lloyd.	Record day's run, 580 knots. [tons.
1899	Oceanic.	White Star Line.	Balanced engines, 1st to exceed 15,000
1900	Deutschland.	Hamburg-American Line.	Fastest ocean steamer in the world.
1901	CELTIC.	White Star Line.	1st to exceed 20,000 tons.
1902	KRONPRINZWILHELM	Norddeutscher Lloyd.	
1903	Kaiser Wilhelm II.	Norddeutscher Lloyd.	Largest express steamer in the world.
1904	Baltic.	White Star Line.	Largest ss. in the world—726x76x49.
"	Victorian.	Allan Line.	1st fitted with turbine engines.
1907	Lusitania.	Cunard Line.	Fastest in the world. Fitted with turbine engines. Record day's run, Mauretania, 676 knots.
"	Mauretania.	" "	Largest ocean liner in commission, October 1, 1912.
1911	Olympic.	White Star Line	Will be the largest vessel inthe world.
1913	Imperator	Hamburg-American Line.	

DEPTHS OF PORTS OF THE WORLD.

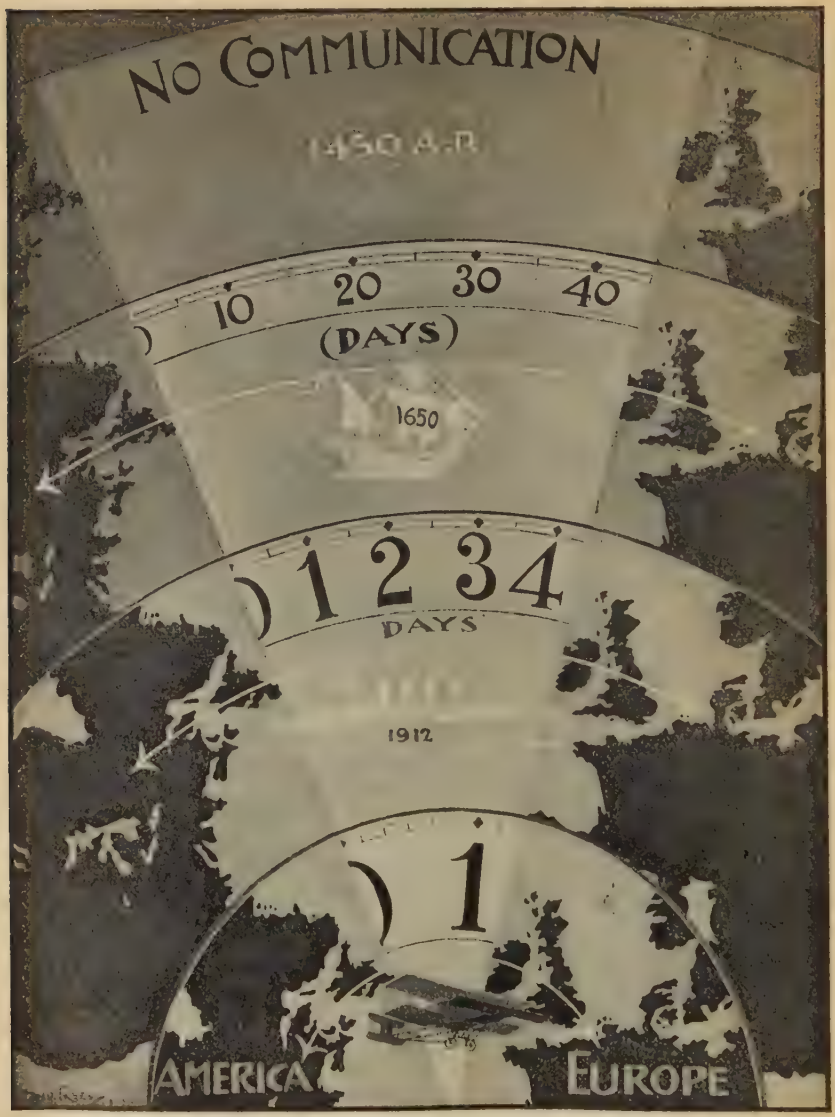
Port.	Channel (mean high water)	Quay (mean high water)	Port.	Channel (mean high water).	Quay (mean high water).
	Feet.	Feet.		Feet.	Feet.
Amsterdam (canal) Holland	30	30	Libau, Russia	22	29
Antwerp, Belgium	37	37	Liverpool, England	55	33
Baltimore, Md	31	31	London, England	42	43
Boston, Mass	36	36	Manchester Ship Canal	28	28
Boulogne, France	29	34	Marseille, France	55	39
Bremen, Germany	18	18	Montreal, Canada	30	35
Bremerhaven, Germany	34	34	Naples, Italy	33	30
Brindisi, Italy	32	32	New Orleans, La	30	40
Cherbourg, France	42	50	New York, N. Y	42	50
Copenhagen, Denmark	26	26	Norfolk, Va	30	30
Dieppe, France	34	34	Ostend, Belgium	31	38
Galveston, Tex	30	28	Philadelphia, Pa	29	32
Genoa, Italy	60	53	Portland, Me	38	38
Glasgow, Scotland	30	38	Rotterdam, Holland	29	29
Greenock, Scotland	36	39	St. Johns, Newfoundland	48	54
Halifax, Nova Scotia	83	45	San Francisco, Cal	39	39
Hamburg, Germany	32	35	Seattle, Wash	(*)	30 to 50
Havre, France	42	30	Southampton, England	41	43
Kaiser William Canal, Germany	29	.....	Stettin, Germany	23	23
Key West, Fla	30	30	Stockholm, Sweden	25	22
Königsberg Canal, Ger	21	.....	Suez Canal, Egypt	28	.....
Leghorn, Italy	22	26	Toulon, France	†26	†23
			Trieste, Austria	30	28

*Deep water.

THE "OLYMPIC" LEAVING HER DOCK AT BELFAST.

MILESTONES OF MARITIME PROGRESS.

1833—Sails to wooden paddles.
1843—Wood to iron hulls.
1850—Paddles to screw-propellers.
1856—Simple to compound engines.
1879—Iron to steel hulls.
1889—Simple to twin-screw.
1906—Triple-expansion to turbine engines.
1907—Quadruple-screw propellers.



Courtesy of "The Sphere."

IF ONLY WE COULD FLY THE ATLANTIC.

ONE WAY BY WHICH THE ICEBERG DANGER WOULD BE AVOIDED

This diagram tells its own story of how we have conquered time and space. The problem of flying to America is now well within the bounds of possibility.

STEAMSHIP RECORDS.

Compiled and Revised by A. W. Lewis, Chief of the Ship News of the "Associated Press."

QUEENSTOWN RECORDS SINCE 1880.

WESTWARD.

Date.	Steamer.	Line.	d.	h.	m.
1880	Arizona	Guion	7	10	47
1882	Alaska	Guion	7	6	43
1884	Oregon	Cunard	6	9	42
1885	Etruria	Cunard	6	5	31
1887	Umbria	Cunard	6	4	42
1888	Etruria	Cunard	6	1	55
1889	City of Paris	Inman	5	19	18
1891	Majestic	White Star	5	18	8
1891	Teutonic	White Star	5	16	31
1892	City of Paris	American	5	14	24
1894	Campania	Cunard	5	9	27
1894	Lucania	Cunard	5	7	23
1895	Campania	Cunard	5	9	6
1898	Etruria	Cunard	5	20	55
1907	Lusitania	Cunard	4	18	40
1907	Mauretania	Cunard	5	0	55
1908	Lusitania	Cunard	4	15	0
1909	Mauretania	Cunard	4	15	55
1909	Lusitania	Cunard	4	11	*42
1909	Mauretania	Cunard	4	10	51
1910	Mauretania	Cunard	4	10	*41

QUEENSTOWN RECORDS SINCE 1882.

EASTWARD.

1882	Alaska	Guion	6	18	37
1884	America	National	6	14	8
1884	Oregon	Cunard	6	11	9
1887	Etruria	Cunard	6	4	36
1889	City of Paris	Inman	5	23	38
1889	City of Paris	Inman	5	22	50
1891	Teutonic	White Star	5	21	3
1892	City of New York	American	5	19	57
1893	Campania	Cunard	5	17	27
1893	Campania	Cunard	5	14	55
1893	Campania	Cunard	5	12	7
1893	Lucania	Cunard	5	13	30
1894	Campania	Cunard	5	9	18
1894	Lucania	Cunard	5	13	11
1894	Lucania	Cunard	5	8	38
1907	Lusitania	Cunard	4	22	50
1907	Mauretania	Cunard	4	22	29
1908	Lusitania	Cunard	4	22	43
1908	Mauretania	Cunard	4	17	21
1909	Lusitania	Cunard	*4	13	41
1909	Mauretania	Cunard	4	15	52
1911	Lusitania	Cunard	*4	15	50

SOUTHAMPTON RECORDS SINCE 1890.

EASTWARD.

1890	Columbia	Hamburg American	6	15	0
1893	Fürst Bismarck	Hamburg American	6	10	55
1897	St. Louis	American	6	10	14
1897	Kaiser Wilhelm der Grosse, North German	Lloyd.	5	17	8

SOUTHAMPTON RECORDS SINCE 1892.

WESTWARD.

1892	Lahn	North German Lloyd	6	22	0
1893	Paris	American	6	9	37
1894	New York	American	6	7	14
1896	St. Louis	American	6	2	24
1896	St. Paul	American	6	0	31
1897	Kaiser Wilhelm der Grosse (North German Lloyd)		5	22	35
1898	Kaiser Wilhelm der Grosse (North German Lloyd)		5	20	10
1910	Kaiser Wilhelm II		5	18	48

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RECORD OF S. S. MAURETANIA.

(Cunard Line.)

WESTWARD.

Date.		d.	h.	m.
1907, Dec.	From Queenstown	5	0	55
1909, July	From Queenstown	4	15	55
1909, Sept.	From Queenstown	4	10	51
1910, Sept.	From Queenstown	4	10	*41

* Record.

EASTWARD.

1907, Dec.	To Queenstown	4	22	29
1909, June	To Queenstown	4	17	21
1909, Sept.	To Queenstown	4	13	*41

RECORD OF S. S. LUSITANIA.

(Cunard Line.)

WESTWARD.

1907, Nov.	From Queenstown	4	18	40
1908, Aug.	From Queenstown	4	15	0
1909, Sept.	From Queenstown	4	11	*42

* Record.

EASTWARD.

1907, Nov.	To Queenstown - -	4	22	50
1908, Oct.	To Queenstown	4	22	43
1909, Oct.	To Queenstown	4	15	52
1911, Jan.	To Queenstown	4	15	*50

RECORD OF S. S. KRONPRINZESSIN CECILIE.

(North German Lloyd Line.)

WESTWARD.

1908, Jan.	From Cherbourg	5	16	0
1908, Aug.	From Cherbourg	5	11	9
1910, Sept.	From Cherbourg	5	10	*23

EASTWARD.

1907, Aug.	To Plymouth	5	11	5
1908, Sept.	To Plymouth	5	8	7
1909, Sept.	To Plymouth	5	7	*25

RECORD OF S. S. LA PROVENCE.

(French Line.)

WESTWARD.

1906, April	From Havre (first trip)	6	9	10
1906, May	From Havre	6	3	35
1906, July	From Havre	6	3	10
1906, Sept.	From Havre	6	2	15
1907, Sept.	From Havre	6	1	*3

EASTWARD.

1906, May	To Havre	6	4	40
1906, June	To Havre	6	2	*48

RECORD OF S. S. FRANCE.

(French Line.)

WESTWARD.

1912, April	From Havre (first trip)	5	23	58

EASTWARD.

1912, May	To Havre	5	20	2

RECORD OF S. S. KAISER WILHELM II.

(North German Lloyd Line.)

WESTWARD.

1903, April	From Cherbourg	5	23	0
1903, Aug.	From Cherbourg	5	15	10
1904, Nov.	From Cherbourg	5	12	25
1909, Nov.	From Cherbourg	5	12	*3

EASTWARD.

1903, May	To Plymouth	6	1	30
1903, Aug.	To Plymouth	5	10	42
1904, Oct.	To Plymouth	5	8	*20

* Record.

STEAMSHIP RECORDS—Continued.

RECORD OF
S. S. KRONPRINZ WILHELM.
(North German Lloyd Line.)

WESTWARD.

Date		d.	h.	m.
1901, Sept.	From Cherbourg (First trip)	6	10	15
1901, Oct.	From Cherbourg	5	21	10
1901, Nov.	From Cherbourg	5	19	6
1901, Dec.	From Cherbourg	5	15	45
1902, Sept.	From Cherbourg	5	11	*57

EASTWARD.

1901, Oct.	To Plymouth	5	9	48
1901, Nov.	To Plymouth	5	8	*18

RECORD OF
THE OLD S. S. DEUTSCHLAND
(Hamburg-American Line.)

WESTWARD.

1900, July	From Plymouth (First Trip)	5	16	24
1900, Sept.	From Cherbourg	5	12	29
1901, Aug.	From Cherbourg	5	12	23
1903, Sept.	From Cherbourg	5	11	54

EASTWARD.

1900, July	To Plymouth	5	15	6
1900, Aug.	To Plymouth	5	11	45
1900, Sept.	To Plymouth	5	7	38
1900, Sept.	To Cherbourg via Plymouth	5	13	30

Her speedy machinery has been removed and she is now a superb cruising yacht of comparatively low speed and is the "Victoria Luise."

The Suez Canal traffic in 1910 was carried on in 4,533 passages. The total net tons carried were 16,581,898 and the receipts therefrom amounted to $24,550,235.93. The average time required for the passage was 16 hours and 54 minutes.

RECORD OF
S. S. KAISER WILHELM DER GROSSE.
(North German Lloyd Line.)

EASTWARD.

Date		d.	h.	m.
1897, Oct.	To Plymouth	5	15	10
1897, Nov.	To Southampton	5	17	8
1899, July	To Cherbourg	5	20	55
1899, Sept.	To Cherbourg	5	17	56
1900, Jan.	To Cherbourg	5	15	50
1901, Oct.	To Plymouth	5	10	*0

WESTWARD.

1897, Sept.	From Southampton (First Trip)	5	22	35
1898, April	From Southampton	5	20	10
1899, Mar.	From Cherbourg	5	21	8
1899, Sept.	From Cherbourg	5	18	15
1899, Oct.	From Cherbourg	5	17	48
1899, Nov.	From Cherbourg	5	17	37
1901, Oct.	From Cherbourg	5	17	22
1901, Nov.	From Cherbourg	5	16	24
1902, April	From Cherbourg	5	18	45
1902, Sept.	From Cherbourg	5	15	*20

*Record.

Up to the end of September, 1911, 89 merchant steamers and yachts have been launched which are fitted with turbine engines, the gross tonnage represented being 357,000 tons. Of the merchant vessels, 50 per cent. are capable of a speed of 20 knots and upwards. The largest of the turbine ships is the Mauretania, with a tonnage of 31,938. Then follow the Lusitania, 31,550, the France, 23,400; Carmania, 19,524; Chiyo Maru, 13,426; Shinyo Maru, 13,500; Tenyo Maru, 13,454; Royal Edward, 11,117; Royal George, 11,146. A combination of reciprocating and turbine engines seems to be gaining ground. There are already nine steamers of nearly 150,000 tons fitted with this combination, the largest being the Olympic.

PROPORTIONAL STEAMSHIP SPEEDS.

Knots.	Miles per Hour.	Feet per Minute.	Feet per Second	Knots.	Miles per Hour.	Feet per Minute.	Feet per Second.
1	1.151	101.333	1.689	13½	15.545	1,368.000	22.800
1½	1.727	152.000	2.533	14	16.121	1,418.666	23.644
2	2.303	202.666	3.378	14½	16.696	1,469.333	24.488
2½	2.879	253.333	4.222	15	17.273	1,520.000	25.333
3	3.454	304.000	5.066	15½	17.848	1,570.666	26.177
3½	4.030	354.666	5.911	16	18.424	1,621.333	27.022
4	4.606	405.333	6.755	16½	19.000	1,672.000	27.866
4½	5.181	456.000	7.600	17	19.575	1,722.666	28.711
5	5.757	506.666	8.444	17½	20.151	1,773.333	29.555
5½	6.333	557.333	9.288	18	20.727	1,824.000	30.400
6	6.909	608.000	10.133	18½	21.303	1,874.666	31.244
6½	7.484	658.666	10.972	19	21.878	1,925.333	32.088
7	8.060	709.333	11.822	19½	22.454	1,976.000	32.933
7½	8.636	760.000	12.666	20	23.030	2,026.666	33.777
8	9.212	810.666	13.511	20½	23.606	2,077.333	34.622
8½	9.787	861.333	14.355	21	24.181	2,128.000	35.466
9	10.363	912.000	15.200	21½	24.757	2,178.666	36.311
9½	10.939	962.666	16.044	22	25.333	2,229.333	37.154
10	11.515	1,013.333	16.888	22½	25.909	2,280.000	37.998
10½	12.091	1,064.000	17.732	23	26.485	2,330.666	38.842
11	12.666	1,114.666	18.577	23½	27.060	2,381.333	39.687
11½	13.242	1,165.333	19.421	24	27.636	2,432.000	40.532
12	13.818	1,216.000	20.266	24½	28.212	2,482.666	41.376
12½	14.394	1,266.666	21.111	25	28.787	2,533.333	42.220
13	14.969	1,317.333	21.955	26	29.938	2,634.666	43.910

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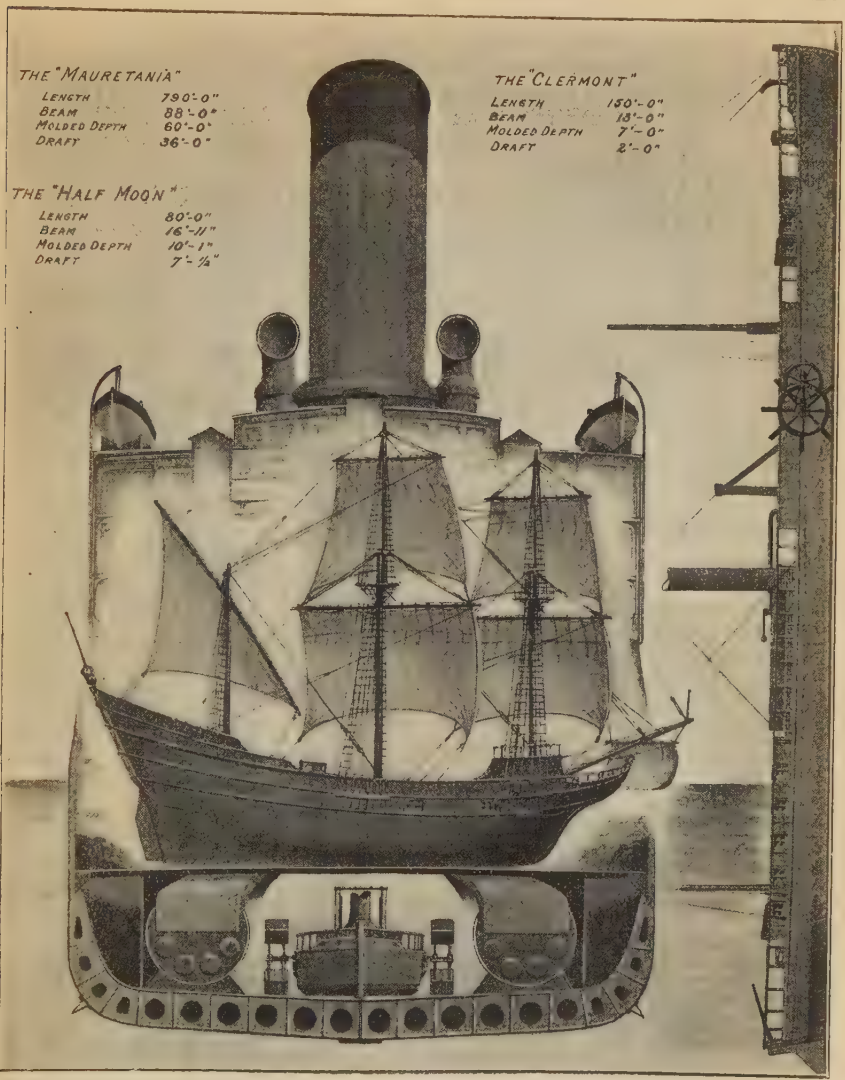

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THE DEVELOPMENT OF OCEAN VESSELS IN THE PAST THREE CENTURIES.

The "Half Moon" of 1609, if the wind favored, could sail about 6 knots. The "Clermont" of 1807 made 4½ knots. The "Mauretania" in 1909 crossed the Atlantic at a 26-knot gait. The engine and boiler rooms of the Mauretania could accommodate five Clermonts placed end to end. The "Half Moon" could be placed athwartship on the deck above with her hull and masts entirely within the ship's structure.

DISTANCES IN KNOTS OR NAUTICAL MILES.

Short Track—Aug. 24 to Jan. 14, East. Aug. 15 to Jan. 14, West. Long Track—Jan. 15 to Aug. 23, East. Jan. 15 to Aug. 14, West.	EASTBOUND		WESTBOUND	
	Short Track	Long Track	Short Track	Long Track
Ambrose Channel Lightship* and—				
Alexandria, Egypt	4,952	4,962	4,945	4,954
Antwerp	3,323	3,432	3,296	3,389
Azores (Ponta del Gada)	2,227	2,231	2,221	2,230
Bremen	3,563	3,692	3,536	3,629
Brow Head	2,744	2,869	2,717	2,823
Cape Race	998	....	....	....
Cherbourg	3,073	3,182	3,046	3,139
Dover	3,190	3,299	3,163	3,259
Fastnet	2,751	2,876	2,724	2,830
Fire Island Lightship	29	....	....	....
Flushing	3,278	3,387	3,251	3,344
Genoa	4,021	4,031	4,013	4,023
Gibraltar	3,168	3,178	3,160	3,170
Hamburg	3,511	3,621	3,485	3,578
Havre	3,145	3,246	3,110	3,205
Liverpool (Landing Stage)	3,033	3,158	3,015	3,124
Lizard Point	2,929	3,038	2,902	2,995
London (Tilbury Docks)	3,257	3,366	3,230	3,326
Nantucket Lightship	193	....	....	....
Naples	4,116	4,126	4,108	4,118
Needles	3,073	3,182	3,046	3,139
Newfoundland (Banks of)	935	....	....	....
Plymouth	2,978	3,087	2,951	3,047
Queenstown	2,814	2,939	2,787	2,893
Roche's Point	2,810	2,935	2,783	2,889
Rotterdam	3,327	3,436	3,300	3,393
Scilly Islands (Bishop Rock)	2,880	2,989	2,853	2,946
Southampton (Docks)	3,095	3,204	3,068	3,161
Philadelphia to Delaware Breakwater, 88 miles.				
Delaware Breakwater and—				
Antwerp	3,397	3,506	3,379	3,472
Fastnet	2,825	2,950	2,807	2,913
Flushing	3,352	3,461	3,334	3,427
Gravesend	3,335	3,444	3,313	3,409
Liverpool (Landing Stage)	3,116	3,241	3,098	3,204
Lizard Point	3,002	3,111	2,985	3,078
London (Tilbury Docks)	3,336	3,445	3,314	3,410
Nantucket Lightship	277	....	....	....
Newfoundland (Banks of)	1,009	....	....	....
Boston (Dock) to Boston Light, 16 miles.				
Boston Light and—				
Antwerp	3,161	3,280	3,126	3,233
Azores (Ponta del Gada)	2,064	2,078	2,064	2,078
Brow Head	2,583	2,718	2,548	2,668
Gibraltar	3,048	3,062	3,048	3,062
Liverpool (Landing Stage)	2,882	3,017	2,947	2,967
Queenstown	2,652	2,787	2,617	2,737
Montreal and—				
Antwerp	3,150	3,254	3,150	3,254
Liverpool (Landing Stage)	2,755	2,968	2,755	2,968
London (Tilbury Docks)	3,082	3,186	3,082	3,186
Quebec	155	....	....	....
Portland to—				
Halifax	326	....	....	....
Liverpool	2,862	2,985	2,819	2,935
New Orleans to—				
Liverpool (Landing Stage)	4,465	4,465	4,465	4,465
London (Tilbury Docks)	4,676	4,676	4,676	4,676

*New York (Battery) to Ambrose Channel Lightship, 25 miles.

MARINE DISASTERS.

Among the marine disasters on record that have resulted in the loss of life are:

1866, Jan. 11.—Steamer London, on her way to Melbourne, foundered in the Bay of Biscay; 220 lives lost.

1866, Oct. 3.—Steamer Evening Star from New York to New Orleans, foundered; about 250 lives lost.

1867, Oct. 29—Royal Mail Steamers Rhone and Wye and about fifty other vessels driven ashore and wrecked at St. Thomas, West Indies, by a hurricane; about 1,000 lives lost.

1870.—Indian Line steamer City of Boston, left New York with 117 passengers and was never heard from.

1871, July 30.—Staten Island ferryboat Westfield exploded in New York Harbor; 100 lives lost.

1873, Jan. 22.—British steamer Northfleet, sunk in collision off Dungeness; 300 lives lost.

1873, Nov. 23.—White Star liner Atlantic wrecked off Nova Scotia; 547 lives lost.

1873, Nov. 23.—French Line steamer Ville du Havre, from New York to Havre, in collision with ship Loch Earn, sank in sixteen minutes; 110 lives lost.

1874, Dec. 26.—Immigrant vessel Cospatrick took fire and sank off Auckland; 476 lives lost.

1875, May 7.—Hamburg mail steamer Schiller wrecked in fog on Scilly Isles; 200 lives lost.

1875, Nov. 4.—American steamer Pacific in collision thirty miles southwest of Cape Flattery; 236 lives lost.

1877, Nov. 24.—United States Sloop of War Huron wrecked off North Carolina coast; 110 lives lost.

1878, Jan. 31.—Steamer Metropolis wrecked off North Carolina; 104 lives lost.

1878, March 24.—British training ship Eurydice, a frigate, foundered near the Isle of Wight; 300 lives lost.

1878, Sept. 3.—British iron steamer Princess Alice sunk in collision in the Thames; 700 lives lost.

1878, Nov. 25.—Steamer Pomerania sunk in midnight collision with a bark in the English Channel; 47 lives lost.

1878, Dec. 18.—French steamer Byzantin sunk in collision in the Dardanelles with the British steamer Rinaldo; 210 lives lost.

1879, Dec. 2.—Steamer Borusia sunk off coast of Spain; 174 lives lost.

1880, Jan. 31.—British training ship Atlanta, left Bermuda with 290 men and was never heard from.

1881, Aug. 30.—Steamer Teuton wrecked off the Cape of Good Hope; 200 lives lost.

1883, July 3.—Steamer Daphne turned turtle in the Clyde; 124 lives lost.

1884, Jan. 18.—American steamer City of Columbus wrecked off Gay Head Light, Mass.; 99 lives lost.

1884, April 19.—Bark Ponema and steamship State of Florida sank in midocean after collision; 145 lives lost.

1884, July 23.—Spanish steamer Gijon and British steamer Lux in collision off Finistere; 150 lives lost.

1886, March 14.—Steamship Oregon, Cunard Line, run into by unknown steamer, eighteen miles east of Long Island, sank eight hours afterward; no lives lost.

1887, Jan. 29.—Steamer Kapunda in collision with bark Ada Melore off coast of Brazil; 300 lives lost.

1887, Nov. 15.—British steamer Wah Young caught fire between Canton and Hongkong; 400 lives lost.

1888, Sept. 13.—Italian steamship Sud America and steamship La France in collision near the Canary Islands; 89 lives lost.

1889, March 16.—United States warship Trenton, Vandalia, and Nipsic and German ships Adler and Eber wrecked on Samoan Islands; 147 lives lost.

1890, Jan. 2.—Steamer Persia wrecked off Corsica; 130 lives lost.

1890, Feb. 17.—British steamer Duburg wrecked in China sea; 400 lives lost.

1890, March 1.—British steamship Quetia foundered in Torres Straits; 124 lives lost.

1890, Sept. 19.—Turkish frigate Ertogrul foundered off Japan; 540 lives lost.

1890, Dec. 27.—British steamer Shanghai burned in China Sea; 101 lives lost.

1891, March 17.—Anchor liner Utopia in collision with British steamer Anson off Gibraltar and sunk; 574 lives lost.

1891, April 16.—British ship St. Catharis wrecked off Caroline Island; 90 lives lost.

1892, Jan. 13.—Steamer Namehow wrecked in China Sea; 414 lives lost.

1892, Oct. 28.—Anchor liner Romania wrecked off Corsica; 113 lives lost.

1893, Feb. 8.—Anchor Line Trinalria wrecked off Spain; 115 lives lost.

1893, February.—Steamer Naronic, White Star Line, lost on the Atlantic and never heard from; 74 lives lost.

1893, June 22.—British battleship Pretoria sunk in collision with the Camperdown off Syria; 357 lives lost.

1894, Nov. 1.—Steamer Wairaro wrecked off New Zealand; 134 lives lost.

1894, June 25.—Steamer Norge wrecked on Rockall Reef in North Atlantic; nearly 600 lives lost.

1895, Jan. 30.—German steamer Elbe sunk in collision with British steamer Crathie in North Sea; 335 lives lost.

1895, March 11.—Spanish cruiser Reina Regenta foundered in Atlantic at entrance to Mediterranean; 400 lives lost.

1897, March 7.—Steamship Ville de St. Nazaire, French Line, burned in a storm off Cape Hatteras; 40 lives lost.

1898, July 2.—Steamship Bourgoyne rammed British steel sailing vessel Cromartyshire and sank rapidly; 584 lives lost.

1904, June 15.—Gen. Slocum, excursion steamboat, with 1,400 persons aboard; took fire going through Hell Gate, East River; more than 1,000 lives lost.

1904, July 3.—Steamship Norge foundered at sea; 750 lives lost.

1905, Sept. 12.—Japanese warship Mikasa sunk after explosion in Sasebo Harbor; 599 lives lost.

1907, Feb. 12.—Steamship Larchmont in collision with Harry Hamilton in Long Island Sound; 183 lives lost.

1907, Feb. 21.—English mail steamship Berlin wrecked off the Hook of Holland; 142 lives lost.

MARINE DISASTERS—Continued.

1907, Feb. 24.—Austrian Lloyd steamship Imperatrix, from Trieste to Bombay, wrecked on Cape of Crete and sunk; 137 lives lost.

1907, January.—British steamship Pengwern foundered in the North Sea; crew and 24 men lost.

1907, January.—Prinz Waldemar, Hamburg-American Line, aground at Kingston, Jamaica after earthquake; 3 lives lost.

1907, February.—French warship Jean Bart sunk off coast of Morocco.

1907, March.—Steamship Congo sunk at mouth of Ems River by German steamship Nerissa; 7 lives lost.

1907, March.—French warship Jena blown up at Toulon; 120 lives lost.

1907, June.—Steamship Aden sunk off Socotra, on the east coast of Africa; 78 lives lost.

1907, July.—Steamship Columbia sunk off Shelton Cove, Cal., in collision with steamship San Pedro; 50 lives lost.

1908, Feb. 3.—Steamship St. Cuthbert, bound from Antwerp to New York, burned at sea off Nova Scotia; 15 lives lost.

1908, April 25.—British cruiser Gladiator rammed by American liner St. Paul off Isle of Wight; 30 lives lost.

1908, July.—Chinese warship Ying King foundered; 300 lives lost.

1908, Aug. 9.—Steamship Prudentia lost on voyage to Argentina.

1908, Aug. 23.—Norwegian steamship Folgefouden sunk; many lives lost.

1908, Nov. 5.—Steamship Archimedes lost in Baltic Sea; 10 drowned.

1908, Nov. 26.—Steamship Finance sunk by steamship Georgic off Sandy Hook; 4 lives lost.

1908, Nov. 6.—Steamship Taish sunk in storm off Etoro Island; 150 lives lost.

1908, Nov. 27.—Steamship San Pablo sunk off Philippine Islands; 100 lives lost.

1908, Dec. 13.—Steamship Ginsei Maru wrecked off Wei-Hai-Wai and crew and passengers drowned.

1908, Dec. 4.—Steamship Soo City foundered off New foundland; crew lost.

1909, Jan. 24.—Steamship Republic rammed off Nantucket by steamship Florida; 8 lives lost in collision; vessel sank; help received by wireless.

1911, Feb. 2.—Steamship Abenton wrecked 70 lives lost.

1911, April 23.—Steamship Asia ran aground; 40 lives lost.

1911, Sept 5.—Steamship Tuscapel wrecked 81 lives lost.

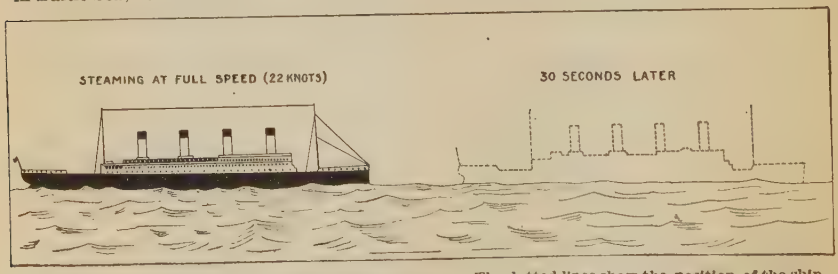
1911, Oct. 2.—Steamship Hatfield in collision and sunk; 20 lives lost.

1911, April 2.—Steamship Koombuna wrecked; 150 lives lost.

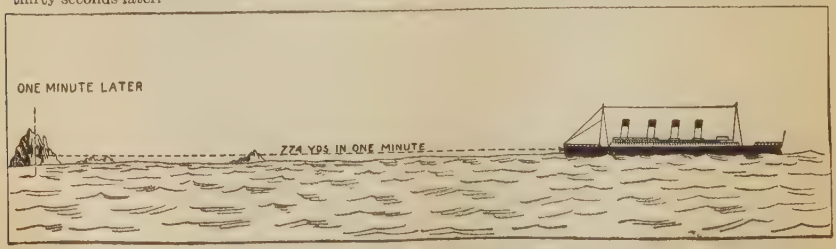
1912, April 15.—Steamship Titanic, White Star Line, struck an iceberg and sank; 1,517 lives lost.

1912, March 21.—Steamship Cachepol sunk after an explosion of her boilers, off the west coast of Peru; 70 lives lost.

1912, April 30.—Coasting boat Texas, Archipelago Steamship Company, sunk by a submarine mine at the entrance to Smyrna Bay; 69 lives lost.



One and one-quarter her own length in half a minute. The dotted lines show the position of the ship thirty seconds later.



If the obstacle were 744 yards away at the moment when sighted the vessel would be upon it in one minute.

The two illustrations give an idea of the speed at which the "Titanic" was passing through the ice fields. If the lookout had called "Iceberg right ahead, Sir," the vessel would have been upon it in one minute if the distance between the bow and the iceberg was 744 yards.

Operations of the United States Life-Saving Service.

During the year ending June 30, 1911 a total of 1,461 vessels were reported by keepers of life-saving stations as having sustained casualties, more or less serious, within the field of service operations. Of these vessels, 397 were documented and 1,064 undocumented, those of the last-mentioned class consisting of launches, sailboats, rowboats, and similar small craft. The documented vessels carried a total of 5,771 persons (including passengers and crews), and were valued with their cargoes at $11,110,810. The undocumented vessels had on board 3,075 persons, and were valued with their cargoes at $877,805. Thirty-seven of the 8,846 persons aboard both classes of vessels were lost—22 from those of the class first-named and 15 from those of the undocumented class.

The foregoing figures and other important data of the year's tabulation of rescue and salvage operations are shown in the following summary, the data for each of the two classes of vessels being given separately:

The total number of vessels involved in casualties was 1,461, and of this number 52 were totally lost. The number of persons on board totaled 8,846, of which number 37 were lost. There were 449 persons succored at the various stations and 739 days' succor afforded.

The value of the vessels involved in the casualties was $9,865,380, of which amount $2,123,235 was estimated as the value of the cargoes. The total value of the property involved was $11,988,615. Of this amount $10,086,975 was saved and $1,901,640 lost.

Of course these figures do not represent the entire amount saved by the service: a considerable portion was saved by salvage companies, wrecking tugs, and other instrumentalities, often working in conjunction with the seamen. It is equally impossible to give an approximate estimate of the number of lives saved. Often a vessel with a long passenger list and a large cargo was saved only by the warning signals of the patrolmen, while in many cases, either where vessels suffered actual loss or where they were warned of danger, no loss of life would have resulted even though no aid had been rendered.

General Summary of Operations Since the Introduction of the Present Life-Saving System, 1871-1911.

Since the introduction of the present life-saving system, the disasters at sea have totaled 22,711, and the number of persons involved 152,038, this number including persons rescued not connected with vessels involved in disaster. The total number of lives lost was 1,314. Eighty-five of these were lost at the disaster to the steamer "Metropolis" in 1877-78, when service was impeded by distance, and fourteen others in the same year owing to similar causes. The number of persons succored at stations, inclusive of those not connected with vessels involved in disaster, was 23,555, and the days' succor afforded, including succor afforded to persons not connected with vessels involved in disaster, was 53,438.

The total value of the vessels involved in disaster was $220,649,945, of which amount $84,371,824 represented the cargoes involved. Of the $305,021,769 of property involved, $245,072,867 worth was saved and $59,948,902 was lost.

United States Steamboat Inspection Service.

This service is now under the jurisdiction of the Department of Commerce and Labor. The Supervising Inspector-General reported that for the fiscal year ending June 30, 1911, the number of annual certificates of inspection issued to domestic steam, motor, sail vessels and barges, was 7,867; number of certificates issued to foreign steamers, 468; making a total number of certificates of inspection amount to 8,335. The number of life-preservers inspected was 210,259, of which number 730 were rejected. The number of marine boiler plates inspected at the mills by assistant inspectors was 3,916. The number of applicants examined for color-blindness, 1,317, of which 30 were rejected on account of this visual defect. In the year there were 7 accidents caused by fire, in which 10 lives were lost; there were 19 collisions, in which 46 lives were lost; there were 11 explosions or accidental escape of steam, in which 42 lives were lost; there were 11 accidents caused by striking snags, wrecks and sinking, involving a loss of 114 lives; there were 111 cases of accidental drowning; and 69 deaths by miscellaneous accidents. During the year 314,768,885 passengers were carried on those vessels which are required to make reports. The total lives lost were 392, so it will be seen that 802,981 passengers were carried for each life lost, whether of passenger or crew.

Coal Consumption of Ocean Steamers.

The amount of coal consumed by a steamship increases much faster than the rate of increase of speed. This is shown in the following table, which applies to a "typical vessel" of 10,000 gross tons.

Knots.	Tons of Coal Consumed per Day.	Number of Firemen Required.	Mileage per Year.
10	44	15	42,000
11	53	18	46,200
12	65	22	50,400
13	79	26	54,600
14	96	32	58,800
15	117	39	63,000
16	144	48	67,200
17	173	58	71,400
18	209	70	75,600
19	254	85	79,800
20	305	102	84,000
21	371	127	88,200

The expenses of a vessel on account of coal alone are thus seen to grow rapidly with increase of speed.

AROUND THE WORLD IN THIRTY-SEVEN DAYS.

When Jules Verne wrote his fascinating story, "Around the World in 80 Days," he probably did not realize that within a comparatively short period this trip could be made in much abbreviated time. In fact Phineas Fogg could now make the complete circuit of the earth in 37 days. The International Sleeping Car Company has worked out the proposition for the editor as follows: Leave New York, by the Twentieth Century Limited for Chicago, then via St. Paul to Vancouver, so as to make an exact connection with the Canadian Pacific express steamer across the Pacific; from Yokohama go to Tsuruga, from there to Vladivostok. The Trans-Siberian is then taken to Moscow; London is then reached, and either the "Lusitania" or the "Mauretania" should be caught in order to make the trip in 38 days. The trip will then be as follows: New York to Vancouver, 4½ days; Vancouver to Yokohama, 18 days; Yokohama to Vladivostok, including necessary layovers, 2½ days; Vladivostok, one day; Vladivostok to Moscow, 10 days; Moscow to London, 2 days; London to New York, 5 days; total, 38 days.

By recent improvements in connections this could be reduced to 37 days.

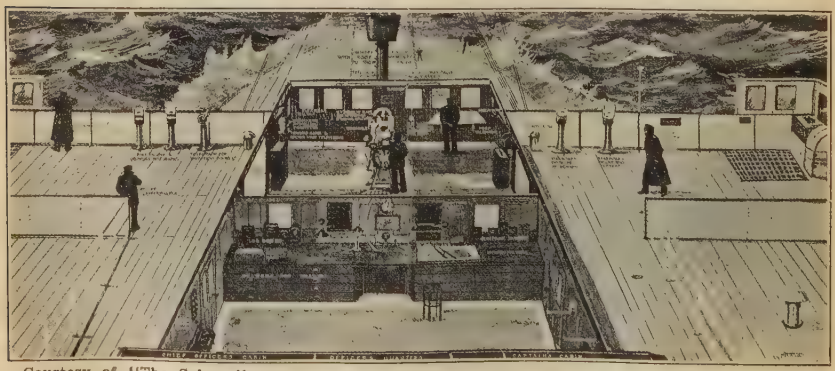
Nellie Bly made the circuit of the globe in 74 days in 1889. If delays credited to lack of transportation were deducted, she would have made the trip in 58 days. Geo. Francis Train made the trip in 1890 in 67 days 12 hours and 3 minutes. In 1901 Charles Fitzmorris made the trip in 60 days 13 hours 29 minutes and 42 2-5 seconds, in the race of schoolboys conducted by the Hearst papers.

Fitzmorris left	Chicago	May 20, 1901
	New York	May 22, 1901
	Berlin	May 30, 1901
	Moscow	June 1, 1901
	Irkutsk	June 10, 1901
	Stretensk, Siberia	June 13, 1901
Fitzmorris left	Blagoveschensk	June 21, 1901
	Vladivostok	June 27, 1901
	Yokohama	July 5, 1901
	Victoria, B. C.	July 16, 1901
Arrived in	Chicago	July 20, 1901

In 1903 Henry Frederick left New York for Hamburg and returned by Vancouver, British Columbia. Elapsed time, 54 days 7 hours 20 minutes. In 1907 Col. Burnley Campbell reduced the time to 40 days 19 hours 30 minutes. In 1911 Andrew Jager-Schmidt made a record-breaking trip, the elapsed time being 39 days 19 hours 42 minutes 37 4-5 seconds.

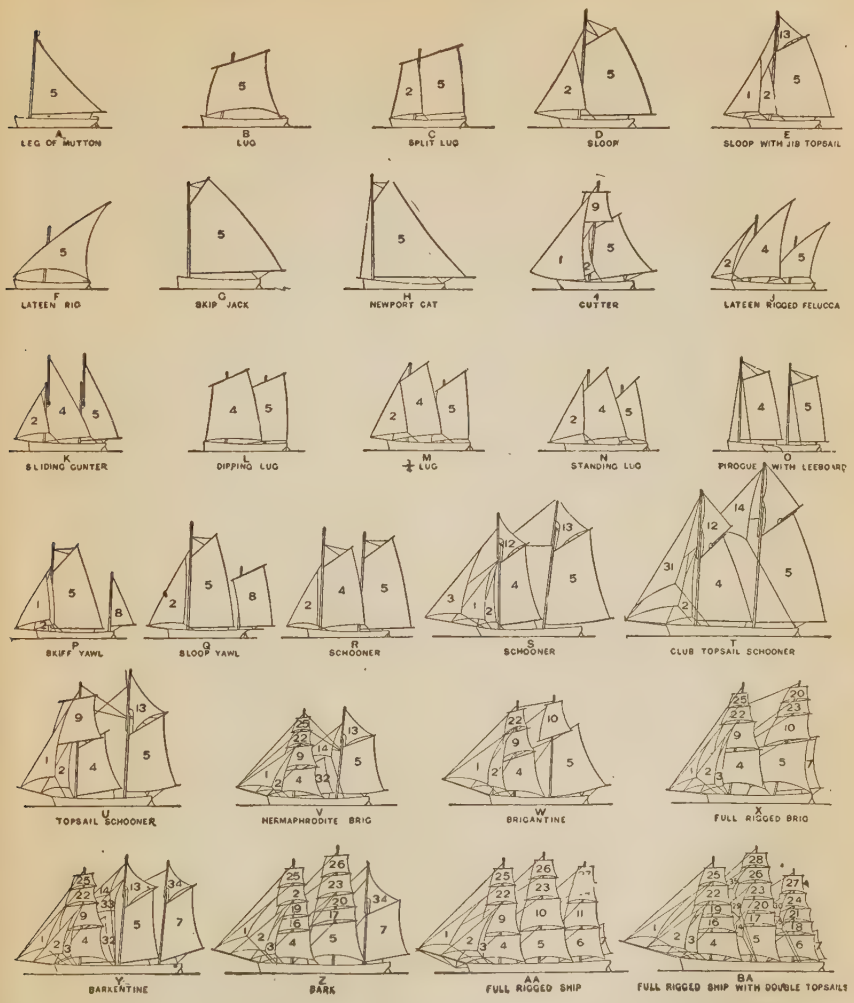
July 17, 1911, 1:15 P.M., left Paris,
July 20, Moscow,
July 22, Omsk,
July 25, Irkutsk,
July 28, Harbin
July 29, Vladivostok,
July 31, Yokohama,
Aug. 12, Vancouver,
Aug. 18, Montreal,
Aug. 19, New York,
Aug. 26, Paris.

This trip comes within three days of the theoretical time imposed by our means of transportation.



Courtesy of "The Sphere."

ON THE BRIDGE OF THE "TITANIC."



RIGS OF SAILING VESSELS.

While there are not quite so many different rigs of sailing vessels as there are vessels, there are a great many, some of them differing but slightly from others, and there is much confusion of nomenclature, even among those who should know better than to get the rigs mixed in their minds. To aid in dispelling misunderstandings as to the names of the rigs of vessels, or as to how certain named rigs are to be understood, the accompanying illustrations have been prepared, showing a wide range from the smallest and the most simple sailing vessels to the largest and most complicated.

In the first place we may make a distinction by reason of the number of masts, which ranges from one to five. The second distinction may be in the manner in which the sails are attached, extended, and maneuvered; some being on horizontal yards swinging

crosswise of the mast, some on yards which lie obliquely to the horizontal, others having booms or gaffs attached at only one end to the mast, and others again having no sprit or spar by which to aid in their extension. Some sails are triangular, others have four well defined sides. Some vessels have all the sails centered at the masts, or are square rigged; in others all the sails are "fore and aft;" and others again have the sails on one or more masts of different type from those on the other or others; while in some, part of the sails on a mast are of one type and the rest of one or more others.

Referring to the illustrations, and considering only the number of masts: A to I inclusive have but one; J to X inclusive, two; and the rest have three. There are vessels having four and even five masts, but these do not require illustration as the sails on the other mast or masts are of the same general type as those on the three.

Of sails we have as distinct types No 5 A, which is a leg of mutton, having a boom to extend its lower edge; 5 B, which is a square sail, having its upper edge extended by a yard and found also at 4 and 5 L, M and N, 4 V, W, X, Y, Z, AA and BA; 5 X, Z, AA and BA, and 6 AA and BA. All these square sails have no yard to extend them on their lower edges.

In vessels F and J there will be seen to be one long yard at an angle to the mast and having its lower end made fast to a convenient point below. This is called a lateen rig.

In vessels D, E, G, H, I, O, P, Q, R, S, T, U, V, W, Y, all sails marked 5 are bent to the mast at their inner edge, and extended by a boom below and a gaff above. These are fore and aft sails. Other fore and aft sails, bent to stays and not to any mast, boom or yard, are the stay sails seen in vessels D, E, I, J, K, M, N, and on all the others from P on, inclusive. The particular sail on vessel A is a leg of mutton sail; on B, a lug sail or lug; on C, a split lug, differing from that on B by one portion being bent to the mast as well as to the yard above. In vessel K may be seen a "sliding gunter," the upper portion of which is extended by a spar which is hoisted alongside of the mast, constituting, practically, a sliding topmast; the sail being bent to both halves of the mast proper. On vessel L there is a dipping lug, and on M a three-quarter lug.

In S we see a schooner the topsails of which, marked 12 and 13, are extended by the topmast and the gaff; these being called gaff-topsails; while in T they have at their lower edges comparatively short spars called clubs, by which they may be more flatly strained than where the attachment is made directly to the corner (or clew) of the sail. In BB we see the topsails double; that is, instead of there being only one sail to the topmast, as in AD, 9, 10, 11, they are double, the upper half being bent to the regular yard above, and the other to a yard which is hoisted on the mast; the object being to enable the sail area to be more readily reduced than by reefing one large sail.

Taking the different rigs in order as lettered, A, is a leg of mutton, B a lug, C a split lug, D a sloop (having a single mast and only fore and aft sails), E a sloop having a gaff topsail, F a lateen rig, G a skipjack (having no bowsprit and no staysail nor topsail), H a cat-boat (which differs from the skipjack only in the hull), I the cutter as known in the United States Navy (distinguished by being sloop rigged, with a square topsail instead of a gaff topsail or a club topsail), J a lateen rigged felucca, K a sliding gunter (having practically a sliding topmast to which as well as to the mast the sail is bent), L a dipping lug, M a three-quarter lug, N a standing lug (one lower corner of the sail being secured to the mast, and the lower edge being extended without a boom), O a pirogue (having no bowsprit, no staysails, and no topsails, and being fitted with a lee board as shown), P a sloop yawl (having a small mast stepped astern and bearing a leg of mutton sail), Q a sloop yawl with a jigger.

R is a schooner having two masts, both fore and aft rigged; this one having no topsails and only one staysail; S a schooner with gaff topsails (sometimes called a gaff topsail schooner), T a schooner with club topsails (sometimes called a club topsail schooner), U a topsail schooner (having a square topsail on the foremast and a gaff topsail on the mainmast), V a hermaphrodite or modified brig (two masted and having the foremast square rigged and the mainmast fore and aft rigged), W a brigantine (having two masts, the foremast being square rigged and the mainmast having square topsails and but a mainsail extended by gaff and boom), X a brig (a two masted vessel square rigged on both masts), Y a barkentine (having three masts, the foremast being square rigged and the other two fore and aft rigged), Z a bark (having three masts, the foremast and mainmast being square rigged and the mizzenmast fore and aft rigged), AA a full rigged ship (having three masts, all square rigged), and BA a full rigged merchant ship (having double topsails as before explained).

The sails as illustrated on all the vessels shown bear the same numbers for the same name throughout. In all, 1 is the flying jib, 2 the jib, 3 the foretopmast staysail, 4 the foresail, 5 the mainsail, 6 the cross jack sail, 7 the spanker, 8 the jigger, 9 the fore topsail, 10 the main topsail, 11 the mizzen topsail, 12 the fore gaff topsail, 13 the main gaff topsail, 14, the main topmast staysail, 15 the mizzen topmast staysail, 16 the lower fore topsail, 17 the lower main topsail, 18 the lower mizzen topsail, 19 the upper fore topsail, 20 the upper main topsail, 21 the upper mizzen topsail, 22 the fore topgallant sail, 23 the main topgallant sail, 24 the mizzen topgallant sail, 25 the fore royal, 26 the main royal, 27 the mizzen royal, 28 the main skysail, 29 the main topgallant staysail, 30 the mizzen topgallant staysail, 31 the jib topsail, 32 the fore trysail, 33 the staysail, 34 the gaff topsail, 35 the main royal staysail.

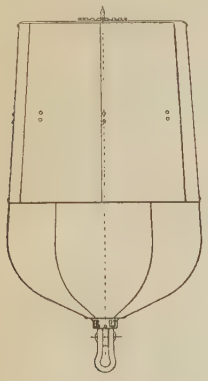
There are other kinds of sails not shown, as for instance studding sails, which are extended by yards on square rigged vessels, and other staysails than those shown may be set when the wind is light and they can be used to advantage to catch any wind.

There are other rigs which embody the features of those already shown, such for example as the three masted, four masted, and five masted schooners, the four masted and five masted ships and the four masted

shipentine, all of which are an extension of the rigs shown.

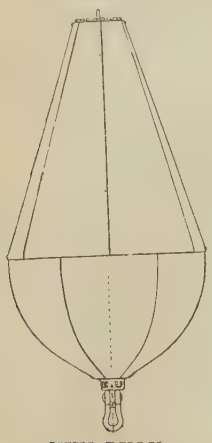
BUOYS.

In the United States it is customary to mark channels with red and black buoys. As the channel is entered from the sea the red buoys are on the starboard, or right side, and the black buoys on the port. Usually there is a difference in form between the two sets of buoys. The starboard or red buoys are of the type known as "nun" buoys,



CAN BUOY

sometimes called "nut" buoys, the part that projects out of the water being conical in form. The port or black buoys are of the type known as "can" buoys, the part that projects out of the water having the form of a



NUN BUOY

plain cylinder or else a slightly tapered cylinder. In winter weather in waters where there is apt to be a great deal of ice, "spar" buoys are used instead of "can" and "nun" buoys, the "spar" buoys having the shape of a spar as the name implies. In Europe buoys are not as consistently used as in the United States and it is impossible for us to summarize here the significance of the different buoys in various European ports. At night certain channels are marked by "light" buoys; that is, buoys fitted with acetylene, Pintsch gas, or electric lights.

NAUTICAL TERMS

Abaft: Toward the stern or end of the vessel.

Aft: Toward the stern or end of the vessel.

Alleyway: The ship's passageway.

Altitude: This is the angular distance of the pole above the horizon.

Bower Anchor: This is an anchor which is ready for immediate use.

Bulkhead: A longitudinal or transverse partition.

Cart: A sea map.

Deadlight: This is a covering of wood or metal used in severe weather to protect glass portholes or windows.

Equinox: This is the equal length of the day and night occurring toward the end of March and September.

Ebb-Tide: Falling tide.

Forward: Toward the bow or front of the vessel.

Fore-and-aft: This refers to the length of the ship.

Fo'castle: This was formerly the seamen's quarters, but in the modern vessel they are quartered almost anywhere near their work.

Fathom: Six feet.

Flood-Tide: Rising tide.

Galley: This is the kitchen.

Height of tide: This is the difference between the level of high water and that of low water.

Larboard: The opposite of starboard; port is the later and more preferred term.

Lee-side: This is the side away from the wind.

Latitude: Distance directly North or South of the Equator.

Longitude: Distance directly East or West of the meridian of Greenwich.

Lights of vessels: These are the port and starboard lights, red and green, respectively, besides a white light in the foretop.

Mid-ship: This means the point which is equidistant between the bow and the stern.

Neap-tide: This is low tide caused by the sun and moon being farthest apart.

Port: This is the left-hand side of the ship looking toward the bow.

Porthole: A stateroom window secured in a massive metal ring adapted to be closed tightly.

Starboard: This is the right-hand side of the ship looking toward the bow.

Scuppers: Channels for water, usually at the outer edge of the deck.

Soundings: Depth of water in fathoms.

Spring-tide: This is high tide caused by the sun and moon being on the meridian together.

Sheet-anchor: This is a spare anchor which is reserved for emergencies.

Thwartship: Crosswise to the ship.

Weather-side: This is the side of the ship toward the wind.

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A GRAPHICAL COMPARISON OF THE PROVISIONS OF A TRANSATLANTIC LINER. (See next page.)

IT IS BETTER TO BE SAFE THAN SORRY.
Testing temperature of sea water.

PROVISIONING THE "KRONPRINZ WILHELM" FOR A SINGLE TRANSATLANTIC TRIP.

The Book of Genesis does not record the tonnage of the huge vessel which finally stranded on Mount Ararat, after finishing the most wonderful voyage ever described in the annals of mankind. But it is quite safe to assume that the dimensions of the Ark, that old-time floating storehouse, are exceeded in size by the largest of steamships now crossing the Atlantic.

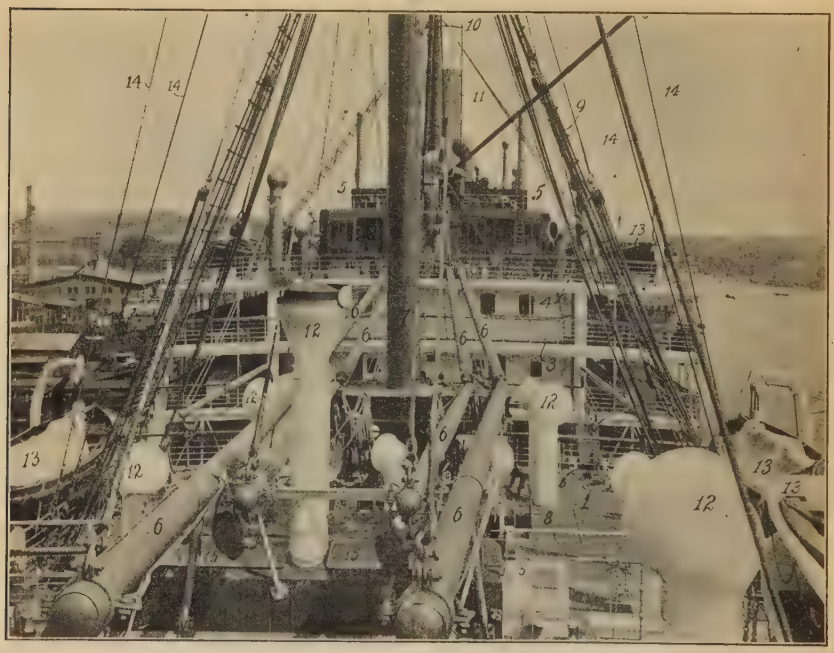
Not the least striking evidence of the size of these modern monsters of the deep is afforded by the vast quantities of food which must be taken aboard for a single six-day trip across the Atlantic. For the 1,500 passengers and the several hundred men constituting the crew, carloads of food and whole tanks of liquids are necessary. To enumerate in cold type the exact quantities of bread, meat, and vegetables consumed in a weekly trip would give but an inadequate idea of the storing capacity of a modern liner. We have, therefore, prepared a picture which graphically shows by comparison with the average man the equivalent of the meat, poultry, and breadstuffs, as well as the liquors used. Each kind of food has been concentrated into a giant unit, compared with which the figure of the average man seems puny.

On the "Kronprinz Wilhelm," of the North German Lloyd Line, which steamship we have taken for the purpose of instituting our comparisons, some 19,800 pounds of fresh meat and 14,300 pounds of salt beef and mutton, in all 34,100 pounds of meat, are eaten during a single trip from New York to Bremen. This enormous quantity of meat has been pictured in the form of a single joint of beef, which, if it actually existed, would be somewhat less than 10 feet high, 10 feet long, and 5 feet wide. If placed on one end of a scale, it would require about 227 average men in the other end to tip the beam.

For a single voyage the "Kronprinz Wilhelm" uses 2,640 pounds of ham, 1,320 pounds of bacon, and 506 pounds of sausage—in all, 4,466 pounds. Since most of this is pork, it may well be pictured in the form of a ham. That single ham is equivalent in weight to 374 average hams. It is 7¼ feet high, 3 feet in diameter and 2 feet thick.

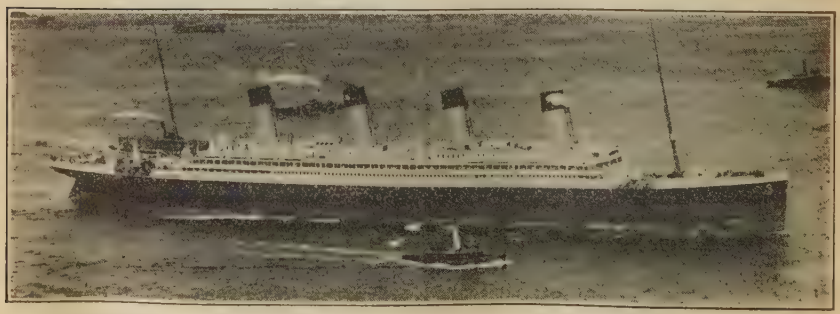
The poultry eaten by the passengers of the steamer during a trip to Bremen or New York weighs 4,840 pounds. Suppose that we show these 4,840 pounds of poultry in the form of a turkey, dressed and ready for the oven. The bird would be a giant 10 feet long, 8 feet broad, and 5 feet high.

Sauerkraut, beans, peas, rice, and fresh vegetables are consumed to the amount of 25,320 pounds. Packed for market, these preserved and fresh vegetables would be contained in 290 baskets of the usual form, which piled up make a formidable truncated pyramid.



THE COMPLICATED GEAR OF A LARGE VESSEL.
Photograph taken on the "George Washington."

1 Main Deck.
2 Lower Promenade Deck.
3 Upper Promenade Deck.
4 Boat Deck.
5 Bridge Deck.
6 Cargo Beams.
7 Mast
8 Cargo Winches.
9 Rigging.
10 Derrick for Heavy Cargo
11 Smoke Funnel.
12 Ventilators.
13 Boats
14 Back Stays.
15 Skylights.

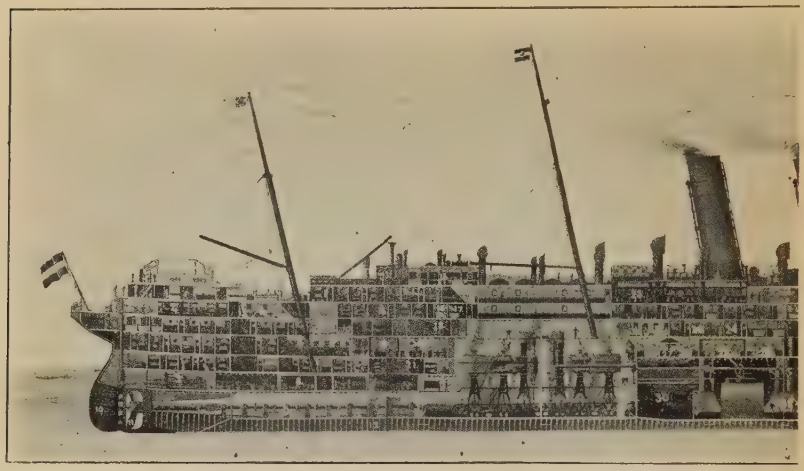


THE OLYMPIC ON HER MAIDEN VOYAGE.

AMIDSHIPS THERE IS MORE SPACE TO WALK ON THE SUN DECK.

1 Smoke Stack.
2 Winter Garden.
3 Boat Deck.
4 Sun Deck.
5 Boats
6 Quadrant Davit.
7 Boat Tackle.
8 Ventilators.
9 Various Deck Houses.
10 Boat Winch.
11 Cargo Beams.
12 Awning Stanchions.

LIFEBOAT DRILL ON A TRANSATLANTIC LINER.
PROVISIONING THE BOATS.
Taken specially for this book.



LONGITUDINAL SECTION OF THE TWIN SCREW-

1. Second Class Promenade Deck
2. Reserve rudder machine
3. Rudder machine
4. Second class Smoking room
5. Second class cabin
6. Second class Ladies' saloon
7. Second class Dining room
8. Baggage room
9. Shaft tunnel
10. Rudder
11. Screw
12. Double bottom
13. Vienna cafe Shelter
14. Vienna cafe (smokers)
15. First class cabin
16. Bathroom
17. Lavatory
18. Post office
19. Second class pantry
20. Second class kitchen
21. Firemen and trimmers
22. Engine room
23. First class Smoking room
24. First class cabins
25. Doctor's cabin
26. Barber's room

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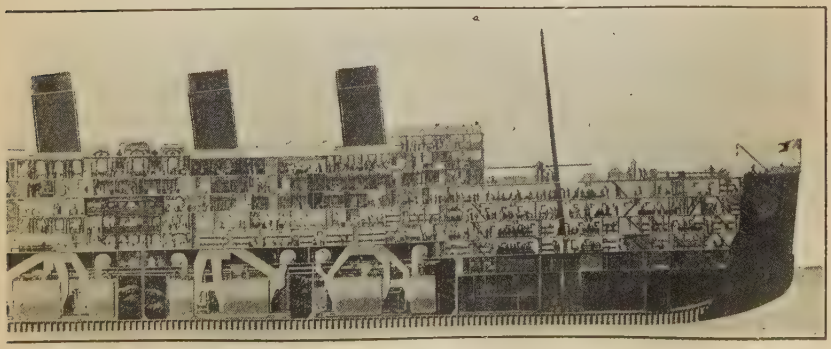
TURBINES.

LONGITUDINAL SECTION OF THE TURBINE-DRIVEN

EXPRESS STEAMER "KAISER WILHELM II."

27. First class kitchen
28. First class pantry
29. Scullery
30. Coal bunkers
31. Boiler room
32. Vienna cafe (non-smokers)
33. Grand staircase
34. Dining room
35. Social Hall
36. Children's saloon
37. Chief Steward's office
38. Imperial suite
39. First class cabins
40. Navigating house
41. Chart house
42. Captain's rooms
43. Reading and Writing room
44. Steerage kitchen
45. Steerage
46. Provision department
47. Goods hold
48. Chains
49. Sails
50. Sailors
51. Anchor machine
52. Anchor



BOILERS.

STEAMER "FRANCE," A FINE TYPE OF LINER.

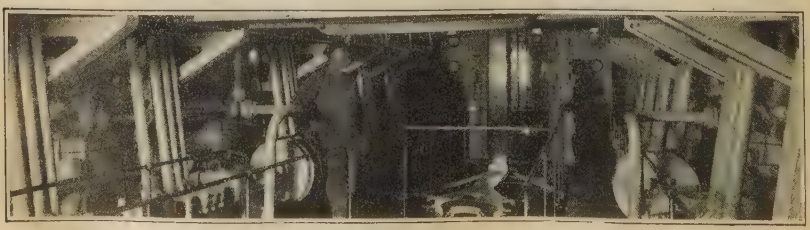
TABLE SHOWING THE DISTANCE OF THE HORIZON AT DIFFERENT ELEVATIONS.

Height	Distance to Horizon	Height.	Distance to Horizon	Height.	Distance to Horizon	Height.	Distance to Horizon	Height.	Distance to Horizon
Feet	Nautical Miles.	Feet	Nautical Miles.	Feet	Nautical Miles.	Feet	Nautical Miles.	Feet	Nautical Miles.
1	1.15	33	6.60	85	10.59	245	17.98	450	24.36
2	1.62	34	6.70	90	10.90	250	18.16	460	24.63
3	1.99	35	6.80	95	11.19	255	18.34	470	24.90
4	2.30	36	6.89	100	11.48	260	18.52	480	25.16
5	2.57	37	6.99	105	11.77	265	18.70	490	25.42
6	2.81	38	7.08	110	12.05	270	18.87	500	25.68
7	3.04	39	7.17	115	12.32	275	19.05	510	25.94
8	3.25	40	7.26	120	12.58	280	19.22	520	26.19
9	3.45	41	7.35	125	12.84	285	19.39	530	26.44
10	3.63	42	7.44	130	13.10	290	19.56	540	26.69
11	3.81	43	7.53	135	13.35	295	19.73	550	26.93
12	3.98	44	7.62	140	13.60	300	19.89	560	27.18
13	4.14	45	7.70	145	13.83	305	20.06	570	27.42
14	4.30	46	7.79	150	14.06	310	20.22	580	27.66
15	4.45	47	7.87	155	14.30	315	20.38	590	27.90
16	4.59	48	7.96	160	14.53	320	20.55	600	28.13
17	4.74	49	8.04	165	14.75	325	20.71	610	28.37
18	4.87	50	8.12	170	14.97	330	20.86	620	28.60
19	5.01	51	8.20	175	15.19	335	21.02	630	28.83
20	5.14	52	8.29	180	15.41	340	21.18	640	29.06
21	5.26	53	8.36	185	15.62	345	21.33	650	29.28
22	5.39	54	8.44	190	15.83	350	21.49	660	29.51
23	5.51	55	8.50	195	16.04	355	21 64	670	29 73
24	5.63	56	8.60	200	16.24	360	21.79	680	29.95
25	5.74	57	8.67	205	16.44	370	22.09	690	30.17
26	5 86	58	8.75	210	16.64	380	22.39	700	30.39
27	5.97	59	8.82	215	16 84	390	22.68	710	30.60
28	6.08	60	8.90	220	17.03	400	22.97	720	30 82
29	6.19	65	9.26	225	17.23	410	23.26	730	31.03
30	6.29	70	9.61	230	17.42	420	23.54	740	31.24
31	6.40	75	9 95	235	17.61	430	23.82	750	31.45
32	6.50	80	10.27	240	17.79	440	24.09	760	31.66

By this Table also the distance can be ascertained at which an object can be seen according to its elevation and the elevation of the eye of the observer.

EXAMPLE.—A tower 200 feet high will be visible at 20¾ miles to an observer whose eye is elevated 15 feet above the water. Thus:—

15 feet elevation, distance visible 4.45 nautical miles
200 " " " 16.24 " " } = 20.69 nautical miles.



ENGINE ROOM, OIL MOTOR-DRIVEN "SELANDIA."

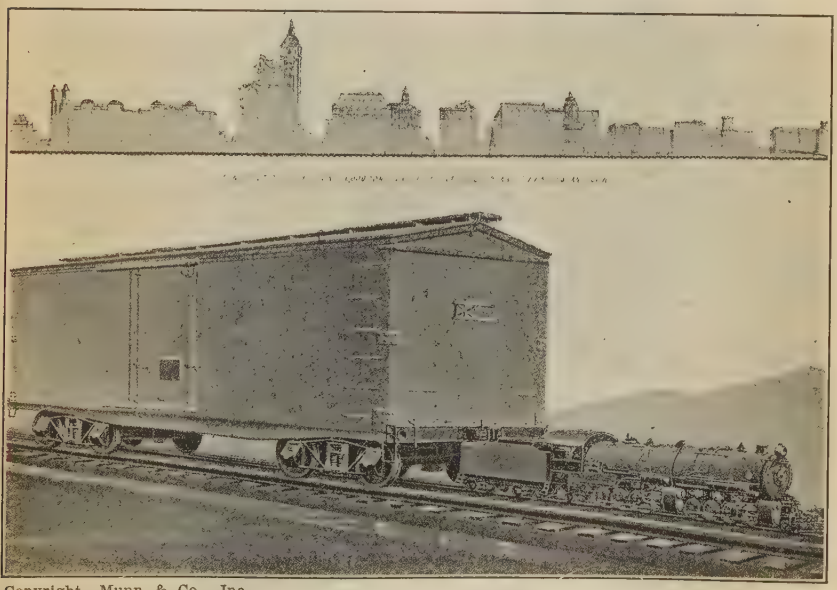
CHAPTER VII.

RAILROADS.

For invaluable information relative to Railroads, both for the United States and foreign countries, the Editor is indebted to Mr. Slason Thompson, Director of the Bureau of Railway News and Statistics, Chicago. A considerable number of the tables are printed through his courtesy, and a painstaking revision of this chapter is also due to him.

In single-track mileage the Bureau figures 95% of the total mileage operating in the United States; in traffic figures they cover 97.5%.

The passenger mileage is obtained by multiplying the number of passengers carried by the average journey in miles. In the case of the United Kingdom that is an approximation of 7.8 miles, from the formula of the London Statist. Same is true of the average haul of 25 miles for freight in the United Kingdom. In this case it is corroborated by the individual figures of the Northeastern Railway of England, which is the only British road giving that information. The ton mileage can be obtained by multiplying the freight tons carried by the average haul in miles.



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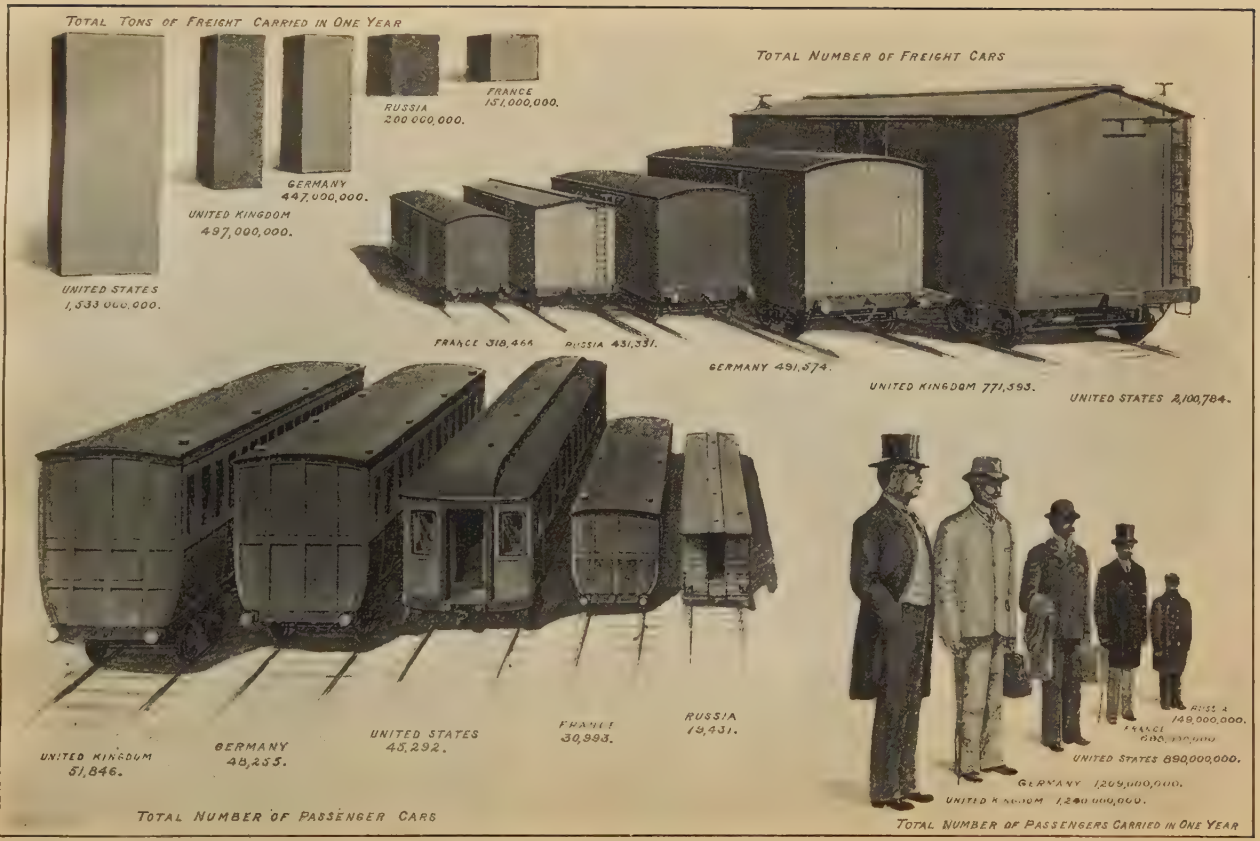
POWER OF A MONSTER LOCOMOTIVE.

This huge Baldwin freight engine, weighing 300 tons, was built for the Southern Pacific Railroad. It is capable of hauling 10 miles an hour a train of 169 cars weighing, with load, 72 tons each. The train, weighing 10,000 tons, would reach for over a mile, or, say, from City Hall Square to the Battery, New York. The lower cut represents the size of a single car, 200 feet by 45½ feet by 62 feet, that would be necessary to contain the load of wheat handled.



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GRAPHICAL COMPARISON OF THE ROLLING STOCK AND FREIGHT AND PASSENGER

GROWTH OF RAILWAYS OF THE WORLD.

In the following table is given the mileage of the principal countries in the world from the earliest date available to the latest:

Country	Miles of Road Completed									
	Opened	1840	1850	1860	1870	1880	1889	1899	1910†	1911†
Great Britain	1825	1,857	6,621	10,433	15,537	17,933	19,943	21,666	23,280	23,387
United States	1827	2,818	9,021	30,626	52,922	93,296	160,544	.....	236,422	243,229
Canada	1836	16	66	2,065	2,617	7,194	12,585	17,250	24,731	25,400
France	1828	.....	1,714	5,700	11,142	16,275	21,899	26,229	29,364	30,119
Germany	1835	341	3,637	6,979	11,729	20,693	24,845	31,386	36,235	37,255
Belgium	1835	207	554	1,074	1,799	2,399	2,776	2,833	2,888	5,132
Austria (proper)	1837	.....	817	1,813	3,790	7,083	9,345	11,921	13,591	13,873
Russia in Europe	1838	.....	310	988	7,098	14,026	17,534	26,889	35,347	41,888
Italy	1839	13	265	1,117	3,825	5,340	7,830	9,770	10,425	10,425
Holland	1839	10	110	208	874	1,143	1,632	1,966	2,235	2,439
Switzerland	1844	.....	15	653	885	1,596	1,869	2,342	2,791	3,034
Hungary	1846	.....	137	1,004	2,157	4,421	6,751	10,619	12,177	12,562
Denmark	1847	.....	20	69	470	975	1,217	1,764	2,121	2,121
Spain	1848	.....	17	1,190	3,400	4,550	5,951	8,252	8,961	9,272
Chili	1851	.....	.....	120	452	1,100	1,801	2,791	3,451	3,451
Brazil	1851	.....	.....	134	504	2,174	5,546	9,195	11,863	12,968
Norway	1854	.....	.....	42	692	970	970	1,231	1,608	1,845
Sweden	1856	.....	.....	375	1,089	3,654	4,899	6,663	8,321	8,554
Argentine Republic	1857	.....	.....	.....	637	1,536	4,506	10,013	14,111	18,166
Turkey in Europe	.....	.....	.....	41	392	727	1,024	1,900	1,967	2,100
Peru	.....	.....	.....	47	247	1,179	993	1,035	1,470	1,470
Portugal	.....	.....	.....	42	444	710	1,118	1,475	1,689	1,689
Greece	1869	.....	.....	.....	6	7	416	604	845	979
Uruguay	1869	.....	.....	.....	61	268	399	997	1,371	1,443
Mexico	1868	.....	.....	.....	215	655	5,012	8,503	14,845	14,990
Roumania	.....	.....	.....	.....	152	859	1,537	1,920	1,976	1,979
Australia*	.....	.....	.....	.....	.....	789	4,850	11,111	17,956	18,195
Japan	1874	.....	.....	.....	.....	75	542	3,632	5,130	5,130
British India	1853	.....	.....	838	4,771	9,162	15,887	23,523	30,809	31,413
China	1883	.....	.....	.....	.....	.....	124	401	4,997	5,274
Africa	.....	.....	.....	.....	.....	583	2,873	5,353	19,207	20,758

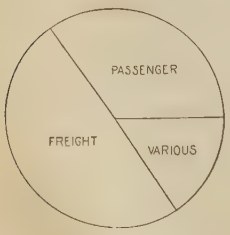
*Including New Zealand.
†Or latest figures.
‡Includes Asiatic Railways.

The proportion of state to privately owned railways as given by Mr. Edwin A. Pratt in "Railways and Nationalization," 1908, was:

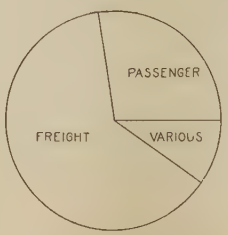
Company Owned Railways	389,000
State Owned Railways	161,000
Total	550.000

STATISTICS OF

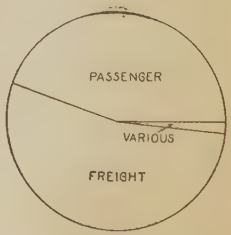
Country	Year	Miles Covered by Capitalization	Capitalization or Cost of Construction (c)	Passenger Revenue	Freight Revenue	Other Revenues
United Kingdom.....	1910	23,387	$6,421,170,080	$210,612,890	$299,397,860	$ 93,499,130
German Empire	1910	36,740	4,163,615,519	200,407,588	456,766,493	71,368,311
France.....	1908	24,915	3,535,954,000	149,648,147	179,700,564	5,367,222
Russian Empire.	1908	41,888	3,378,839,810	80,787,020	306,014,545	39,811,560
Austria.....	1909	13,873	1,609,853,523	42,460,000	128,000,000	12,380,000
Hungary.....	1909	12,562	814,534,000	22,537,800	59,593,600	4,290,600
Italy (a).....	1909-10	8,810	1,131,300,000	35,000,550	56,188,090	6,469,360
Spain.....	1905	8,432	649,919,610	16,215,866	34,694,555	6,190,271
Portugal.....	1908	1,465	162,385,280	4,039,350	5,715,150	351,750
Sweden.....	1908	8,242	270,124,168	12,147,936	21,493,600	885,976
Norway.....	1909-10	1,845	77,142,728	2,416,542	3,224,308	338,498
Denmark (a)...	1908-09	1,215	63,625,230	5,254,200	5,491,260	740,880
Belgium (a)....	1909	2,678	491,185,000	17,241,269	35,505,641	572,621
Holland (a).....	1909	1,902	(d)158,000,000	11,608,800	11,774,800	1,313,200
Switzerland.....	1909	3,034	330,030,000	17,130,680	21,005,279	1,658,642
Roumania.....	1908-09	1,979	186,320,270	5,214,582	8,816,240	773,351
Total Europe..	.....	192,967	23,433,999,218	$832,723,220	$1,633,381,985	$246,011,372
Canada.....	1911	25,400	1,398,089,701	50,566,894	124,743,015	13,423,585
Argentina.....	1909	15,363	862,811,760	23,720,160	70,144,320	6,325,920
Japan (a).....	1910	4,624	384,812,007	19,685,266	18,468,172	2,964,780
British India.	1910	32,099	(f)1,448,700,000	63,261,000	100,419,000	5,049,000
New South Wales.....	1911	3,760	248,228,770	10,100,380	17,458,950	1,866,540
United States...	1911	243,229	14,434,309,000	(a) 658,772,785	1,929,335,456	230,672,156



Great Britain.



Germany.



France.

SOURCES OF REVENUE.

FOREIGN RAILWAYS.

Total Revenues	Operating Expenses	Per Cent Expenses to Revenues	Passengers Carried	Average Journey (Miles)	Freight Tons Carried	Average Haul (Miles)	Per Cent Net Revenues to Capital
$ 603,509,880	$ 372,891,030	61.8	1,758,426,383	(b) 7 8	514,428,803	(b)25.0	3.59
728,542,392	495,125,338	67.9	1,540,872,110	14.2	531,527,817	60.4	5.74
334,715,933	190,388,324	57.9	479,396,165	20.7	158,165,909	80.7	4.08
426,613,125	344,497,405	80.8	162,117,000	79.0	229,554,000	160.1	2.43
182,840,000	148,740,000	81.3	241,955,522	19.0	152,185,817	62.0	2.12
86,422,000	59,742,600	69.1	124,234,000	20.1	66,896,000	69.9	3.28
97,658,000	79,850,083	77.3	72,457,360	25.0	35,600,512	(b)66.0	1.57
57,100,692	27,750,936a	48.6	41,846,249	(b)26.0	22,662,548	69.4	4.50
10,106,250	4,672,500	46.2	14,585,698	(b)20.0	4,315,385	(b)54.0	3.35
34,527,512	28,040,840	81.2	54,163,160	16.5	33,086,800	44.0	2.43
5,979,348	4,421,464	73.9	12,598,036	15.9	4,684,053	38.8	2.18
11,486,340	10,689,840	93.0	21,302,909	21.7	4,800,604	53.3	1.29
53,319,531	36,773,255	67.7	160,107,172	14.8	54,682,253	49.3	3.37
24,696,800	20,597,760	83.4	44,501,000	17.8	16,146,900	51.2	2.59
39,794,601	27,044,511	67.9	105,038,663	12.3	16,165,115	45.3	3.86
14,804,173	9,769,081	66.0	8,319,958	42.6	6,384,406	(b)96.5	2.72
$2,712,116,577	$1,860,994,965	68.6	4,841,921,385	15.5	1,851,286,922	63.8	.....
188,733,493	131,034,784	69.4	37,097,718	70.0	79,884,282	20.0	3.12
100,190,400	59,509,920	59.4	51,060,084	24.2	32,594,871	120.9	4.71
41,118,281	21,030,494	51.1	128,306,960	21.9	23,655,620	80.8	5.22
168,729,000	89,595,000	53.1	371,580,000	36,1	65,600,000	184.3	5.46
29,424,540	16,975,170	61.1	60,919,628	T0.2	10,054,796	80.6	4.61
2,818,780,398	(e)2,044,620,071	72.5	979,101,000	34.2	1,727,988,000	147.8	5.36

(a)State only. (b)Estimated. (c)From latest report, not always year named. (d)Estimated capital cost of Holland's railways not given since 1897 (e)Including taxes. (f)Valuing the Indian ruppe at 33 cents (.324½).

DISTANCES ACROSS NEW YORK CITY.

From Pier 1, North River, via Battery place and Whitehall street to East River, one-half mile; from foot of Dey street, North River, to foot of Fulton street, East River, three-quarters of a mile; from foot of Chambers street, North River, via Chambers, New Chambers and James slip to East River, one mile; from foot of Canal street, North River, to Broadway, three-quarters of a mile; from foot of Canal street, North River, to Bowery, one mile and an eighth; from foot of Canal street, North River, to foot of Grand street, East River, two and an eighth miles; from foot of West Houston street to foot of East Houston street, two and an eighth miles; from foot of West Fourteenth street to Broadway, one and an eighth miles; from foot of West Fourteenth street to foot of East Fourteenth street, two and three-eighths miles; from foot of West Twenty-third street to Sixth avenue, one mile; from West Twenty-third street to foot of East Twenty-third street, two and three-eighths miles. North of Twenty-third street the average width of the island of Manhattan is from two to two and a half miles.

SUMMARY OF THE WORLD'S RAILWAYS AND RATIO OF MILEAGE TO AREA AND POPULATION IN EACH COUNTRY IN 1909.

Countries	Miles 1909	Miles of Line per 100 Sq. Miles 1909	Inhabitants per Mile of Line
I EUROPE			
Germany	37,338	17.9	1,613
Austria-Hungary (including Bosnia and Herzegovina)	27,165	10.5	1,724
Great Britain and Ireland	23,286	19.2	1,786
France	30,186	14.6	1,299
Russia in Europe (including Finland 2,182 miles)	36,912	1.8	2,857
Italy	10,439	9.5	3,125
Belgium	5,144	45.2	1,300
Luxemburg	318	31.7	745
Netherlands	1,926	15.1	2,632
Switzerland	2,850	17.9	1,160
Spain	9,293	4.8	2,000
Portugal	1,798	5.0	3,030
Denmark	2,165	14.6	1,042
Norway	1,865	1.4	1,190
Sweden	8,573	5.0	599
Servia	421	2.3	5,880
Roumania	2,085	4.0	2,858
Greece	982	3.9	2,500
Bulgaria	1,085	2.9	4,000
Turkey in Europe	968	1.4	6,250
Malta, Jersey, Isle of Man	68	16.1	5,550
Total for Europe 1909	204,864	5.5	1,923
" " " 1908	201,619	5.3	1,941
" " " 1907	199,345	5.3	1,887
" " " 1906	196,437	5.2	1,993
" " " 1905	192,507	5.1	2,084
" " " 1904	189,806	5.0	2,084
" " " 1903	186,685	5.0	2,084
" " " 1902	183,989	4.9	2,127
" " " 1901	180,817	4.8	2,174
" " " 1900	176,396	4.7	2,220
" " " 1899	172,953	4.6	2,220
" " " 1898	167,614	4.4	.....
" " " 1897	163,550	4.3	.....
" " " 1896	160,030	4.2	.....
Increase in thirteen years	44,834	.....	.....
II AMERICA			
Canada	24,099	0.6	269
United States (including Alaska)	237,182	6.6	370
Mexico	15,013	1.9	971
Brazil	12,997	0.32	1,639
Argentine Republic	15,850	1.4	307
Chili	3,290	1.0	1,010
Peru	1,471	0.32	3,125
Uruguay	1,447	2.1	720
Total America including other Divisions	319,281	1.95	552

SUMMARY OF THE WORLD'S RAILWAYS AND RATIO OF MILEAGE TO AREA AND POPULATION IN EACH COUNTRY IN 1909—Continued.

Countries	Miles 1909	Miles of Line per 100 Sq. Miles 1909	Inhabitants per Mile of Line
III ASIA			
Russia in Central Asia	4,066	1.9	2,326
Siberia and Manchuria	6,423	0.13	1,099
China	5,296	0.13	83,300
Japan (including Corea)	5,767	2.4	11,000
British India	31,483	1.6	9,090
Total Asia including other Divisions	61,788	0.38	14,660
IV AFRICA			
Egypt	3,503	1.0	3,226
Algiers and Tunis	3,134	1.0	2,128
South African Union	8,939	0.9	770
Total Africa including other Divisions	20,805	0.18	6,180
V AUSTRALIA			
New Zealand	2,681	2.6	381
Victoria	3,430	3.9	370
New South Wales	3,763	1.3	423
South Australia	2,082	0.16	208
Queensland	3,843	0.6	236
Tasmania	627	2.4	300
West Australia	2,321	0.16	203
Total Australia including Islands	18,838	0.6	318
RECAPITULATION			
I Europe	204,864	5.5	1,923
II America	319,281	1.95	552
III Asia	61,788	0.38	14,660
IV Africa	20,805	0.18	6,180
V Australia	18,838	0.6	318
Total for the World	625,576	1.2	2,726
" " " " 1908	611,434	.....	.....
Increase	14,142	.....	.....

RELATION OF RAILWAYS TO AREA AND POPULATION (See page 241.)

Although this table is favored by railway statisticians in comparing railway conditions relatively to area and population, it is doubtful whether it conveys an adequate impression of the exceptionally favorable transportation facilities enjoyed by the inhabitants of this continent, and especialy those of the United States and Canada. For instance, the figures mean that the United States with 800,000 square miles less territory and not one-quarter the population, has 36,000 more miles of railway than all Europe, while Canada, having a territory in which the United Kingdom could be lost thirty times, and only one-sixth the population, has actually more railway mileage than the parent kingdom.

TWO DECADES IN RAILWAY PROGRESS.

RAILWAY RESULTS IN THE UNITED STATES FOR YEARS ENDING JUNE 30, 1891, 1901 AND 1911 WITH PERCENTAGES OF INCREASE BY DECADES.

Item (m=thousands)	1891	1901	1911	1911 over 1891 %	1911 over 1901 %
Population	63,844,000	77,612,569	93,983,000	47.2	21.1
Miles of Line (operated)	161,275	195,562	243,229	50.8	24.4
Miles of All Track	207,446	265,352	358,313	72.7	35.1
Net Capitalization (m)	$7,860,219	$9,482,640	$14,434,309	83.7	52.2
" " per Mile of Line	49,920	49,925	59,345	18.8	18.8
" " " " " Track	37,890	36,547	40,257	6.2	10.1
Gross Earnings from Operation (m)	1,096,761	1,588,526	$2,818,780	157.1	77.6
" " per Mile Operated	6,800	8,123	11,588	70.4	42.6
Expenses of Operation (m)	731,887	1,030,397	1,935,511	164.5	87.8
" " per Mile Operated	4,538	5,269	7,957	75.3	50.8
Net Earnings from Operation	364,873	558,129	883,268	142.1	58.2
" " per Mile Operated	2,262	2,854	3,631	60.5	27.2
Ratio of Expenses to Earnings	66.73%	64.86%	68.66	4.4	5.8
Receipts from Passengers (m)	$281,178	351,356	658,772	134.3	87.5
" " Freight (m)	736,793	118,543	1,929,335	161.9	72.5
" " Mail (m)	24,870	38,453	51,287	106.2	33.4
" " Express (m)	21,594	31,122	72,704	237.2	133.6
Passengers Carried (m)	531,183	607,278	979,101	84.5	61.0
" " One Mile (m)	12,844,243	17,353,588	33,508,240	160.9	93.0
Average Receipts per Passenger Mile (cents)	2.142	2.013	1.966	d 8.9	d 2.4
" Passengers in Train	42	42	58	38.3	38.3
Freight Tons Carried (m)	675,608	1,089,226	1,727,988	155.8	58.7
" " Carried One Mile (m)	81,073,784	147,077,136	255,448,802	215.1	73.6
Average Receipts per Ton Mile (mills).	8.95	7.50	754	d 18.7	0.5
Locomotives, Number	32,139	39,584	61,107	90.0	54.3
" Weight without Tender (tons)	1,331,977	2,177,340	4,672,700	238.1	114.6
Passenger Cars (number)	27,949	35,969	49,448	76.9	37.7
Freight Cars (number)	947,300	1,464,328	2,203,616	132.6	50.5
" " capacity (tons)	21,687,900	39,536,856	81,096,724	274.0	107.6
Average Tons in Train	181	281	404	123.2	43.7
Employes (number)	784,285	1,071,169	1,695,000	116.2	58.2
" per 100 Miles of Line	486	548	697	43.8	27.2
" Compensation	$438,704,400	$610,713,701	1,230,800,000	183.1	101.5
Proportion of Gross Earnings	40.00%	38.39%	43.67%	9.1	13.7
" of Operating Expenses	59.95%	59.27%	63.55%	.....	.....
Taxes	$33,280,095	$50,944,372	$109,108,490	227.5	110.1
Per Mile of Line	206	260	448	117.4	71.5
Proportion of Gross Earnings	3.04%	3.20%	3.87%	.....	.....

NOTE FOR TABLE ON NEXT PAGE.

#Census figures 1910 divided by commission's figures for 1910.
†Mileage operated in Canada by American roads.
‡Mileage operated in Mexico by American roads.

SUMMARY OF RAILWAY MILEAGE IN THE UNITED STATES, BY STATES, FOR THE YEARS ENDING JUNE 30, 1910 AND 1911.

	Bureau's Figures		Commission's Figures		
	1911 Miles Operated	1910 Miles Operated	1910 Miles Owned	Miles of Line per 100 Sq. Miles of Territory	Population Per Mile of Line 1910#
Alabama	4,994	4,992	5,226	10.19	409
Arizona	1,962	1,811	2,097	1.84	97
Arkansas	4,253	4,177	5,306	10.10	296
California	6,610	6,422	7,772	4.99	306
Colorado	5,646	5,598	5,532	5.34	144
Connecticut	1,000	1,002	1,000	20.75	1,115
Delaware	340	340	337	17.04	604
Florida	3,769	3,839	4,431	8.08	169
Georgia	6,631	6,498	7,056	12.02	369
Idaho	1,925	1,962	2,178	2.61	149
Illinois	13,257	12,751	11,878	21.20	474
Indiana	7,098	7,345	7,420	20.59	364
Iowa	9,987	9,945	9,755	17.55	228
Kansas	9,216	9,146	9,007	11.01	184
Kentucky	3,494	3,425	3,526	8.77	649
Louisiana	4,477	4,294	5,554	12.23	298
Maine	2,096	2,068	2,248	7.52	330
Maryland	1,326	1,292	1,426	14.35	901
Massachusetts	2,087	2,086	2,115	26.31	1,592
Michigan	8,360	8,458	9,021	15.69	311
Minnesota	8,893	8,596	8,669	10.72	239
Mississippi	3,672	3,343	4,506	9.72	399
Missouri	8,336	8,329	8,083	11.76	407
Montana	4,294	4,221	4,207	2.88	89
Nebraska	6,151	6,150	6,067	7.90	196
Nevada	1,601	1,685	2,276	2.07	35
New Hampshire	1,213	1,213	1,245	13.80	345
New Jersey	2,146	2,193	2,260	30.08	1,122
New Mexico	2,975	2,939	3,032	2.48	108
New York	8,338	8,103	8,430	17.09	1,081
North Carolina	4,110	4,089	4,932	10.12	447
North Dakota	4,379	4,130	4,201	5.99	137
Ohio	9,028	8,906	9,134	22.42	521
Oklahoma	5,896	5,648	5,980	8.62	277
Oregon	2,125	1,793	2,284	2.39	294
Pennsylvania	10,894	10,530	11,290	25.18	678
Rhode Island	196	196	212	19.88	2,557
South Carolina	2,878	2,878	3,442	11.29	440
South Dakota	3,984	3,739	3,947	5.14	148
Tennessee	3,587	3,553	3,815	9.15	572
Texas	13,081	12,847	14,281	5.44	272
Utah	1,819	1,821	1,985	2.42	188
Vermont	936	941	1,100	12.06	323
Virginia	4,436	4,396	4,534	11.26	454
Washington	5,133	4,543	4,875	7.29	234
West Virginia	2,885	2,787	3,600	14.99	339
Wisconsin	7,106	6,746	7,475	13.53	312
Wyoming	1,457	1,457	1,645	1.69	89
Dist. of Columbia	52	52	36	59.55	9,174
Canada†	1,760	1,383	.....	.....	.....
Mexico‡	226	230	.....	.....	.....
United States	232,117	227,525	240,438	8.08	382

SUMMARY OF MILEAGE OF SINGLE TRACK, SECOND, THIRD AND FOURTH TRACK AND YARD TRACK AND SIDINGS IN THE UNITED STATES, 1890 TO 1911.

Year	Single Track	Second Track	Third Track	Fourth Track	Yard Track and Sidings	Total Mileage Operated (all Tracks)
1911 Bureau (95%).....	232,117	23,454	2,429	1,677	87,524	347,201
1910 Official	*240,831	21,659	2,206	1,489	85,581	351,767
1909 "	*235,402	20,949	2,169	1,453	82,376	342,351
1908 "	*230,494	20,209	2,081	1,409	79,452	333,646
1907 "	227,455	19,421	1,960	1,390	77,749	327,975
1906 "	222,340	17,396	1,766	1,279	73,760	317,083
1905 "	216,973	17,056	1,609	1,215	69,941	306,796
1904 "	212,243	15,824	1,467	1,046	66,492	297,073
1903 "	205,313	14,681	1,303	963	61,560	283,821
1902 "	200,154	13,720	1,204	895	58,220	274,195
1901 "	195,561	12,845	1,153	876	54,914	265,352
1900 "	192,556	12,151	1,094	829	52,153	258,784
1899 "	187,543	11,546	1,047	790	49,223	250,142
1898 "	184,648	11,293	1,009	793	47,589	245,333
1897 "	183,284	11,018	995	780	45,934	242,013
1896 "	182,428	10,685	990	764	44,912	240,129
1895 "	180,657	10,639	975	733	43,888	236,894
1894 "	178,708	10,499	953	710	42,661	233,533
1893 "	176,461	10,051	912	668	42,043	230,137
1892 "	171,563	9,367	852	626	39,941	222,351
1891 "	168,402	8,865	813	599	37,318	215,999
1890 "	163,597	8,437	760	561	35,255	208,612

*Since 1908 the official mileage is exclusive of switching and terminal companies. In 1908 these had 1,624 miles of main track and 2,085 of yard tracks and sidings; in 1909 they reported 1,623 miles of main track and 2,384 of yard tracks and sidings and in 1910 they reported 1614 and 2270 miles respectively.

If the mileage of auxiliary track given in the above table for 1911 be added to the single track mileage covered by the monthly reports to the Interstate Commerce Commission for June, 1911 (243,732 miles), it yields a total of 358,816 miles of all track, an increase of over 10,000 for the year. As each mile of track stands for an expenditure of $40,000, this shows that during the year ending June 30, 1911, at least $400,000,000 was irrevocably invested in fitting our railways to the transportation needs of the American people.

In other words, American railways, in one year of great business depression, were forced by the normal but irresistible pressure of national growth to expend on additional facilities more than the estimated cost of the Panama Canal!

This table shows that there were almost as many miles of auxiliary track in the United States in 1911 (115,084 miles) as the combined single track mileage of Germany, Austria, Hungary, France and the British Isles (117,975).

From 1908 to 1910 the rate per ton mile in the United Kingdom was 2.33 cents; in France, 1.36 cents; in Germany, 1.41; Russia, .95; Austria, 1.36; Sweden, 1.60; Norway, 1.77; Denmark, 2.00; Holland, 1.35; Belgium, 1.17; and in Switzerland, 2.86 cents. No recent ton mile statistics for Italy are available, though taking the average haul as under 70 miles, the average receipts per ton mile were probably in the neighborhood of 2.25 cents.

At the end of the year 1910 there were 13,660 passenger locomotives in the service, 34,992 freight locomotives, 9,115 switching, and 1,180 unclassified, making a total of 58,947 locomotives in the service.

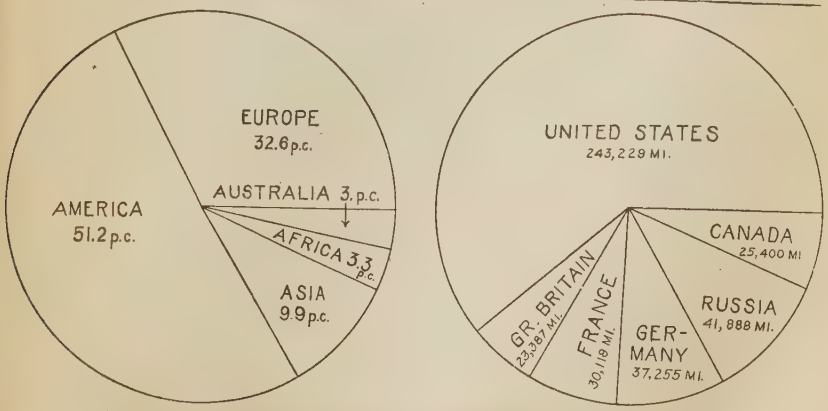
SUMMARY CLASSIFICATION OF LOCOMOTIVES AND THEIR PRINCIPAL CHARACTERISTICS: 1910.

Class.	Number.	Tractive power.	Grate surface.	Heating surface.	Weight exclusive of tender.	Weight on drivers.
		Pounds.	*Sq. ft.*	*Sq. ft.*	*Tons.*	*Tons.*
Single expansion	55,867	1,502,296,608	1,862,769	117,725,234	4,032,797	3,314,673
Average per locomotive		26,891	35	2,107	72	59
Four-cylinder compound	1,511	59,594,482	61,467	5,272,515	168,787	131,278
Average per locomotive		39,440	49	3,489	112	87
Two-cylinder compound	862	27,003,390	32,021	2,197,380	72,624	60,858
Average per locomotive		31,326	39	2,549	84	71
Total	58,240	1,588,894,480	1,956,257	125,195,129	4,274,208	3,506,809
Average per locomotive		27,282	35	2,150	73	60

The above table does not include locomotives in the service of terminal companies.

DISTANCES IN NEW YORK.

From the Battery. Miles.	TO	From the Battery. Miles.	TO	From the Battery. Miles.	TO	From the Battery. Miles.	TO
¼	Rector.	4½	East 54th.	8¾	East 139th.	13	East 199th.
½	Fulton.	4¾	East 58th.	9	East 144th.	13¼	S. Mosholu P'k-w'y & Web. av.
¾	City Hall.	5	East 63d	9¼	East 149th.	13½	East 205th.
1	Leonard.	5¼	East 68th.	9½	East 154th.	13¾	East 208th.
1¼	Canal.	5½	East 73d.	9¾	East 159th.	14	W'msbridge sta.
1½	Spring.	5¾	East 78th.	10	East 164th.	14¼	Jerome ave., c.
1¾	E. Houston.	6	East 83d.	10¼	Spring pl.		Woodlawn rd.
2	East 4th.	6¼	East 88th.	10½	East 168th.	14½	Jerome ave., c.
2¼	East 9th.	6½	East 93d.	10¾	East 170th.		Mt. Vernon av.
2½	East 14th.	6¾	East 97th.	11	East 172d.	14¾	Jerome ave., c.
2¾	East 19th.	7	East 102d.	11¼	East 174th.		East 133d.
3	East 24th.	7¼	East 107th.	11½	Tremont ave.	15	E. 237th, c. Mt. Vernon ave.
3¼	East 29th.	7½	East 112th.	11¾	East 179th.		
3½	East 34th.	7¾	East 117th.	12	East 182d.	15¼	East 239th.
3¾	East 38th.	8	East 121st.	12¼	East 186th.	15⅜	City line.
4	East 44th.	8¼	East 128th.	12½	Pelham ave.		
4¼	East 49th.	8½	East 134th.	12¾	East 195th.		



COMPARISON OF WORLD'S RAILWAYS BY CONTINENTS AND PRINCIPAL COUNTRIES.

RAILROAD LOCOMOTIVES AND CARS.

At the end of the year 1910 there were 57 passenger locomotives for every thousand miles of line, 145 freight locomotives, 38 switching locomotives, 5 unclassified, making a total of 245 locomotives per thousand miles of line. There were 9,510 cars per thousand miles of line, divided as follows: 195 passenger cars; 8,866 freight cars; and 449 company's service. At the end of the same year it was estimated that 70,288 passengers were carried per passenger locomotive; 2,354,748 passenger miles covered per passenger locomotive; 52,504 tons carried per freight locomotive; and 7,304,065 ton miles covered per freight locomotive. For every million passengers carried there were 48 passenger cars, and for every million tons of freight carried there were 1,157 freight cars employed.

At the end of the year 1910 there were 47,095 passenger cars in the service; 2,135,121 freight cars; and 108,115 company cars, making a total of 2,290,331 cars in the service. The fast freight line service required 29,209 cars for its service.

Figuring the cost of a locomotive at $15,000, the 59,909 locomotives required for the 232,117 miles of track operated in 1911 cost $898,635,000; the 48,479 passenger cars, valued at $6,500 each, cost $315,113,500; the freight cars, 2,160,408 in number, valued at $1,000 each, cost $2,160,408,000; and the 111,605 company cars, valued at $600 each, cost $66,963,000. Thus the approximate value of all equipment of American railways was $3,441,119,500. The single item maintenance of equipment for the year 1911 amounted to $423,250,273.

ELECTRIC LOCOMOTIVES.

The New Haven has the heaviest electric locomotive, with the weight on its drivers of 162,000 pounds, a maximum guaranteed speed of 86 miles, and is designed to trail a load of 250 tons. The Grand Trunk (St. Clair Tunnel) locomotive has a weight on the drivers of 132,000 pounds, a guaranteed speed of 30 miles an hour, and is designed to trail a load of 500 tons. The Pennsylvania R. R. locomotive having a weight on the drivers of 207,800 pounds and a guaranteed speed of 80 miles, is designed to trail a load of 550 tons. The N. Y. C. & H. R. R. R.'s largest electric locomotive, having a weight on the drivers of 141,000, has a guaranteed speed of 75 miles per hour. The Baltimore & Ohio has electric locomotives having a weight of 184,000 pounds on the drivers, a guaranteed speed of 55 miles, and is designed to trail a load of 850 tons. The Paris-Orleans locomotive has a weight on the drivers of 110,000 pounds and a maximum guaranteed speed of 45 miles. The Great Northern's largest electric locomotive has a weight of 230,000 pounds on the drivers and a maximum guaranteed speed of 30 miles.

HEAVY LOCOMOTIVES.

Locomotives for railway service cost approximately as follows: Mogul, for freight service, having an average weight of 160,000 pounds, cost $14,100; Consolidation, for freight service, average weight 200,000 pounds, cost $18,500; Mallet Compound, for freight service, average weight 400,000 pounds, cost $40,000; Atlantic, for passenger service, average weight 185,000 pounds, cost $15,970; Pacific, for passenger service, average weight 225,000 pounds, cost $20,800; and Ten Wheel, for passenger service, average weight 170,000 pounds, cost $15,000.

Wood box cars (with steel underframe) weighing 35,970 pounds, having a capacity of 80,000 pounds, and inside dimensions of 30′ x 8′ 6″ x 8′ 3″, cost $850; steel coal (hopper), weight 39,400 pounds, capacity 110,000 pounds, inside dimensions 30′ 6″ x 9′ 5″ x 10′ 6″, cost $1,000; flat cars, weight 31,000 pounds, capacity 80,000 pounds, inside dimensions 41′ x 9′ 2″, cost $600; day coach, weight 112,000 pounds, capacity 80 passengers, dimensions 78′ 3″ x 10′ x 14′ 5″, cost $8,500; sleeping car (wood), weight 115,000 pounds, capacity 27 berths, inside dimensions 72′ 6″ x 8′ 6″ x 9′ 6″, cost $16,700; sleeping cars (steel), weight 152,300 pounds, capacity 24 berths, inside dimensions 72′ 6″ x 9′ 9″ x 9′ 6″, cost $27,000.

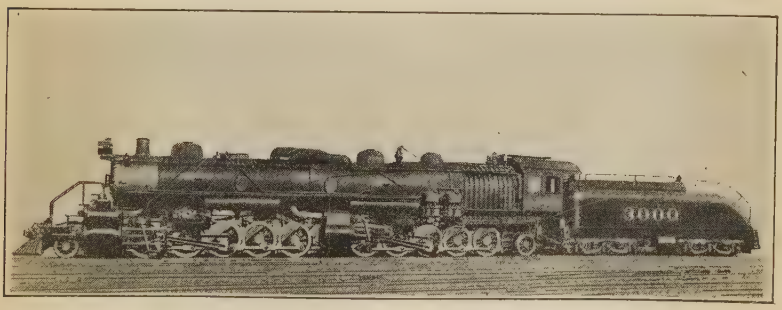
A dining car costs $30,000 to $35,000. A combination café car costs about $28,000. We are indebted to the "World Almanac" for many of these interesting figures.

The Mallet Compound, built for the Atchison, Topeka & Santa Fé, having a total weight of 616,000 pounds, and a weight of 550,000 pounds on its drivers, is the largest and most powerful locomotive in the world. It has ten drivers on each side, having a diameter of 57 inches, and was built by the Santa Fé by converting a 2-10-2 type locomotive by the addition of a front unit. From the tip of the pilot to the end of the tender it is 121 feet 7 inches long. It has a heating surface of 6,579 square feet. Its cylinders are 28 x 38 x 32 inches and its tractive effort is 111,600 pounds. It was built for operation over the A., T. & S. F. from Los Angeles to Albuquerque, where the maximum grade ranges from 2.2 per cent. to 3 per cent. The locomotive burns fuel oil, and the tender has a capacity of 4,000 gallons.

The Mallet Compound passenger locomotive, built by the A., T. & S. F., is the heaviest passenger locomotive ever built. Its total weight is 376,850 pounds and the weight on its drivers, 73 inches in diameter, is 268,400 pounds. It has a heating surface of 4,756 square feet. Its cylinders are 24 x 38 x 28 inches and its tractive effort is 62,850 pounds. It is for use on a division having 2.2 per cent. grades, and over which the schedule speed averages about 25 miles.

SUMMARY OF COST OF LOCOMOTIVE FUEL AND PROPORTION TO EARNINGS AND EXPENSES OF AMERICAN RAILWAYS.

At the end of the year 1911 it was estimated that there were 232,117 miles of railroad and that the total cost of locomotive fuel for operating trains over them was $226,904,756, or 12.037 per cent. of the total operating expenses of the roads or again 8.26 per cent. of the gross earnings of the roads.



This huge locomotive was enlarged at the Santa Fe shops from an existing locomotive by adding the superheater and feed-water sections. The engine weighs 308 tons, the tender 117 tons, making the total weight 425 tons. Its length over all is 120 feet 7½ inches. The H.P. cylinders are 28 inches dia; the L.P. are 38 inches dia.; the common stroke is 32 inches. The max. drawbar pull is 111,000 pounds, and this locomotive has hauled 1,911 tons at 12 miles per hour over a 1.5 per cent grade. On the level it could haul a train so long that the side tracks could not take it in. At a speed of 10 miles an hour, estimated in the usual manner, it would develop about 3,000 horse-power, which at higher speeds, would be still greater. The fire-box has 204 square feet of heating surface, and the tubes 3,625 square feet. The gases next pass through the tubes of a superheater of 2,318.4 square feet surface and then through a feed-water heater of 2,659.5 square feet. The steam passes from the steam dome to the superheater; through the high-pressure cylinders; back to the low-pressure superheater; through the low-pressure cylinders, and to the exhaust stack.

SANTA FE MALLET FREIGHT LOCOMOTIVE, THE LARGEST IN EXISTENCE.

SUMMARY OF RAILWAY EMPLOYEES, COMPENSATION AND RATES OF PAY PER DAY BY CLASSES IN 1911, AGGREGATES FROM 1899 TO 1911.

1911 (232,117 Miles Represented) Class	Number	Per 100 Miles of Line	Compensation	Average Pay Per Day	Per Cent of Gross Receipts
General Officers	3,590	1.5	$17,149,205	$15.30	0.6
Other Officers	9,708	4.2	21,063,206	6.38	0.8
General Office Clerks	76,150	32.8	61,524,102	2.49	2.2
Station Agents	36,737	15.8	27,982,195	2.20	1.0
Other Station Men	153,526	66.1	95,335,487	2.00	3.5
Enginemen	62,491	26.9	99,951,666	4.72	3.6
Firemen	65,490	28.2	59,111,680	2.94	2.2
Conductors	47,346	20.4	64,956,106	4.18	2.4
Other Trainmen	131,949	56.9	120,956,345	2.92	4.4
Machinists	54,812	23.6	51,001,629	3.17	1.9
Carpenters	65,413	28.2	50,141,432	2.71	1.8
Other Shopmen	226,381	97.5	154,745,875	2.25	5.6
Section Foremen	43,825	18.9	30,338,045	2.07	1.1
Other Trackmen	354,808	152.9	135,167,605	1.50	4.9
Switch Tenders, Crossing Tenders and Watchmen	40,202	17.3	22,937,413	1.73	0.8
Telegraph Operators and Despatchers	40,986	17.7	34,179,264	2.42	1.3
Employees acct. Floating Equpt.	10,378	4.5	7,823,985	2.29	0.3
All other Employees & Laborers.	224,139	96.6	146,794,567	2.11	5.3
Total(95%Mileage Represented)	1,647,931	710.0	1,201,259,607	2.42	43.7
1910 Official Figures	1,732,435	716	$1,165,444,855	(b) $2.29	41.82
1909	1,528,808	638	1,005,349,958	2.24	41.00
1908	1,458,244	632	1,051,632,225	2.25	43.38
1907	1,672,074	735	1,072,386,427	2.20	41.42
1906	1,521,355	684	(a) 930,801,653	2.09	40.02
1905	1,382,196	637	839,944,680	2.07	40.34
1904	1,296,121	611	817,598,810	No data	41.36
1903	1,312,537	639	775,321,415	No data	40.78
1902	1,189,315	594	676,028,592	No data	39.28
1901	1,071,169	548	610,713,701	No data	38.39
1900	1,017,653	529	577,264,841	No data	38.82
1899	928,924	495	522,967,896	No data	39.81
1898	874,558	474	495,055,618	No data	39.70
1897	823,476	449	465,601,581	No data	41.50
1896	826,620	454	468,824,531	No data	40.77
1895	785,034	441	445,508,261	No data	41.44
1894	779,608	444	No data	No data	.....
1893	873,602	515	No data	No data	.....
1892	821,415	506	No data	No data	.....
1891	784,285	486	No data	No data	.....
1890	749,301	479	No data	No data	.....
1889	704,743	459	No data	No data	.....

(a) Includes $30,000,000 estimate pay-roll of Southern Pacific, whose records were destroyed in the San Francisco disaster.

(b) Bureau computations.

NUMBERS OF DIFFERENT CLASSES OF FREIGHT CARS.

At the close of the year 1910 the several classes or kinds into which freight cars are divided, were as follows: box cars, 966,577; flat cars, 153,918; stock cars, 77,584; coal cars, 818,689; tank cars, 7,434; refrigerator cars, 30,918; and other cars 78,411. The average capacity in tons of a box car was 33; of a flat car 33; a stock car 30; a coal car 41; a tank car 39; a refrigerator car 30; and of other cars 37.

PASSENGER TRAFFIC.

A summary of the passenger traffic for the year 1911 shows that there were 959,000,000 passengers carried; that there were 32,837,769,000 passengers carried one mile; and that the mileage of all the passenger trains amounted to 558,000,000. The average number of passengers in a train were 58; the average journey was 34 miles; and the average receipts per passenger mile were 1.966 cents. The passenger revenue amounted to $645,000,000.

FREIGHT TRAFFIC.

At the end of the fiscal year 1910 the grand total of freight traffic for the United States amounted to 1,745,324,828, plus 104,575,273 tons—the latter amount being unassigned freight, while the former was assigned. The products of agriculture, having a total freight tonnage of 160,401,693, were divided as follows: grain, 67,733,043 tons; flour, 19,729,851; other mill products, 15,632,126; hay, 11,744,710; tobacco, 1,833,353; cotton, 6,122,624; fruits and vegetables, 27,968,788; and other products of agriculture, 9,637,198 tons.

The products of animals, totaling 38,624,775 tons, were divided as follows: live stock, 18,200,325 tons; dressed meats, 5,953,431; other packing-house products, 4,651,120; poultry, game and fish, 1,512,280; wool, 904,324; hides and leather, 3,014,630; and other products of animals, 4,388,665 tons.

From the products of mines the total freight traffic amounted to 942,065,847 tons and was divided as follows: anthracite coal, 117,480,501; bituminous coal, 467,060,739; coke, 77,990,907; ores, 158,179,430; stone, sand and other like articles, 98,861,001; other products of mines, 22,493,269.

The products of the forests, divided into lumber, 135,677,828 tons, and other products of forests, 57,561,905 tons, amounted to 193,239,733 tons for the year 1910.

The manufactures of the United States, making a total freight tonnage of 278,157,500, were divided according to freight traffic as follows: petroleum and other oils, 16,531,174; sugar, 7,056,371; naval stores, 1,743,122; iron, pig and bloom, 28,963,137; iron and steel rails, 9,378,658; other castings and machinery, 27,274,820; bar and sheet metal, 34,074,515; cement, brick and lime, 59,626,450; agricultural implements, 3,249,071; wagons, carriages, tools, etc., 3,223,308; wines, liquors and beers, 6,785,150; household goods and furniture, 4,081,175; and other manufactures, 76,170,549 tons.

The freight traffic for merchandise amounted to 61,234,757 tons and for miscellaneous other commodities 71,600,523 tons.

SUMMARY OF FREIGHT MILEAGE, REVENUE, AND RECEIPTS PER TON MILE.

During the year 1901 the number of tons carried one mile amounted to 147,077,136,040 and during the year 1911 to 250,440,118,000; thus making a total increase for the ten years of 70.4 per cent. The freight revenue for the year 1901 amounted to $1,118,543,014 and for 1911 to $1,889,504,180; making an increase of 68.9 per cent. for the ten years. The receipts per ton-mile in 1901 amounted to 7.50 mills and in 1911 to 7.54 mills.

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MAGNITUDE OF LEADING RAILROAD LINES OF THE WORLD REPRESENTED BY SIZE OF LOCOMOTIVES.

PASSENGER REVENUES.

Analyzing the revenues of the passenger service for the fiscal year 1890, we find that the revenue per passenger per mile was 2.167 cents; the revenue per passenger carried, $0.50818; the revenue per train-mile, passenger trains, $1.08641; and the passenger earnings per mile of road, $1,978.19. For the freight service for the same year the revenue per ton per mile amounted to 0.927 cents; the revenue per ton of freight carried $1.08781; the revenue per train-mile, freight trains, $1.65434; freight earnings per mile of road, $4,588.82. Thus the total revenue per train-mile for all trains amounted to $1.44231, and the cost of running a train one mile $0.96006.

In 1900 the passenger revenues were as follows: revenue per passenger per mile 2.003 cents; revenue per passenger carried $0.56459; revenue per train-mile, passenger trains, $1.01075; passenger earnings per mile of road $2,067.17. The freight revenues for the same year were: revenue per ton per mile 0.729 cents; revenue per ton of freight carried $0.99373; revenue per train-mile, freight trains, $2.00042; freight earnings per mile of road $5,466.47. Thus the revenue per train-mile for all trains amounted to $1.65721 and the cost of running a train one mile $1.07288.

The passenger revenues for the year 1910 were divided into revenue per passenger per mile, 1.938 cents; revenue per passenger carried, $0.64617; revenue per train-mile, passenger trains, $1.303.96; and passenger earnings per mile of road, $3,228.00. On the freight service the revenue per ton per mile amounted to 0.753 cents; the revenue per ton of freight carried $1.03992; the revenue per train-mile, freight trains, $2.86218; the freight earnings per mile of road, $8,089.00. Thus the revenue per train-mile for all trains amounted to $2.24628 and the cost of running a train one mile $1.48865. The term "ton" generally signifies the short ton of 2,000 pounds.

CONSUMPTION OF FUEL OIL.

The increasing use of fuel oil is due to many causes. It has been demonstrated from tests made on some of the railroads accessible to the oil fields and refineries of the West, where fuel oil can be purchased cheaply, that the cost of operating with oil is less and its use equally as efficient as coal, the supplies of which are at times very low and uncertain on account of strikes and shutdowns of mines, and often on account of shortage of cars for the transportation of the coal, especially in the winter season. In some localties where oil is coming into use, as in Nevada, the cost of coal is extremely high. Another reason for the use of oil is the prevention or the elimination of forest fires, which in the last few years have been so disastrous in the northwestern part of the country. In addition to the economy of the use of oil as compared with coal on railroads, it is very much cleaner and safer for the traveler, there being no smoke or cinders.

In 1910 there were 22,709 lines of mile operated by the use of fuel oil. The total quantity of fuel oil consumed by railroads for the same year amounted to 24,586,108 barrels. The total mileage made by oil-burning engines for that year was 89,107,883 and the average number of miles traveled per barrel of oil consumed was 3.74.

REVENUES AND EXPENSES.

A general summary of the monthly reports of revenues and expenses of steam roads shows that the average number of miles of road operated during 1911 was 243,229.38. The operating revenues, which amounted to $2,818,780,398.46, or an average of $11,588.98 per mile of road operated, were distributed as follows: freight, $1,929,335,456.59; passenger, $658,772,785.78; other transportation, $202,762,574.20; non-transportation, $27,909,581.39. The operating expenses, amounting to $1,935,511,581.13, or an average of $7,957.56 per mile of road operated, were divided as follows: maintenance of way and structures, $369,581,610.47; maintenance of equipment, $431,-

892,653; traffic, $59,344,440.93; transportation, $1,000,603,053.40; general, $74,046,630.37.

The total net operating revenue of $885,341,355.51, $883,268,817.33 of which was derived from rail operations and $2,072,538.18 from outside operations; less the taxes, amounting to $109,108,490.26, leaves an operating income of $776,232,865.25, or an average of $3,191.36 per mile of road operated.

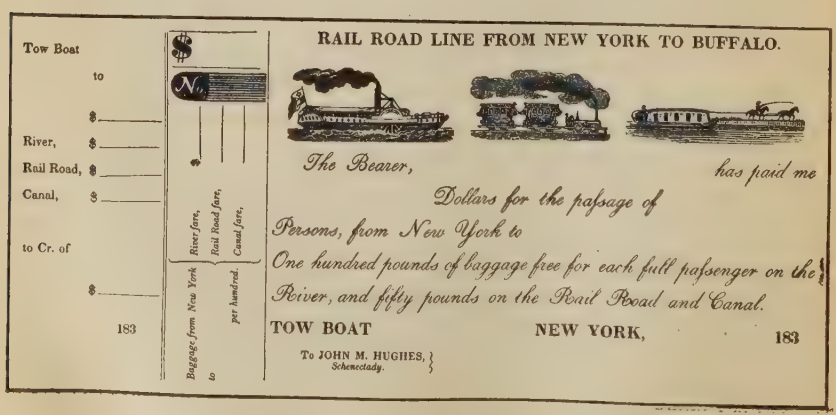
At the close of the year ending June 30, 1890, the railroads had a total of $4,409,658,453 stocks outstanding, of which $1,598,131,933, or 36.24 per cent., were paying dividends. This stock of the railroads paid dividends at an average rate of 5.45 per cent. The railroads paid $87,071,613 dollars in dividends and $221,499,702 interest on the funded debt, making a total of $308,571,315. The interest on interest-bearing current liabilities amounted to $8,114,768.

In 1900 the total stock of the railroads was $5,845,579,593 and the stock-paying dividends amounted to $2,668,969,895, or 45.66 per cent. of the total amount of stock. The average rate paid was 5.23 per cent., making a total of $139,597,972 paid in dividends. The interest on the funded debt amounted to $252,949,616, making a total expenditure on dividends and interest on the funded debt of $392,547,588. The interest on the interest-bearing current liabilities amounted to $4,912,892.

At the end of the year 1910 the total outstanding stocks were $8,113,657,380 and the stock-paying dividends amounted to $5,412,578,457, or 66.71 per cent. of the total stock. The average rate paid on dividends was 7.50 per cent., or $405,771,416. The interest on the funded debt amounted to $399,582,056, making a total of $805,353,472 paid for interest on the debt and dividends. The interest on the interest-bearing current liabilities amounted to $16,536,695.

At the end of the fiscal year 1910 the assets for the 226,114.66 miles of railroad represented in the Interstate Commerce Commission's report were as follows: Net investment in road and equipment, $14,387,816,099; book value of system securities permanently held, $2,337,178,510; other permanent investments, $1,588,439,670; working assets and accrued income not due, $2,139,006,497; sinking and redemption funds, $95,693,704; and all other deferred debit items, $558,764,533.

The liabilities for the same number of miles of road and for the same year were as follows: stock, $8,062,814,700; mortgage, bonded and secured debt, $10,388,107,332; working liabilities and accrued liabilities not due, $1,123,354,632; deferred credit items, $161,514,590; appropriated surplus, $331,870,965; and profit and loss, $1,039,236,794.



RAILROAD TICKET OF THE EARLY THIRTIES.

RAILROAD SPEEDS.

Month, day, year.	Railroad.	From.	To.	Dist. Miles.	Time, h. m. s.	Speed miles per H.
6-14-'80	P.R.R.	Philadelphia	Jersey City	90	1:33:00	58.06
0- 0-'80	Gt. N. (Eng.)	London	Grantham	105.5	1:51:00	66.5
4-22-'82	W. Jersey	Camden	Cape May	81.5	1:23:30	58.63
7-12-'83	B. S. & N. Y.	Syracuse	Binghamton	79	1:23:00	57.11
5- 9-'84	P. & R.	N. Y. Div.	M. P. 48	14	0:11:19	74.2
5- 8-'85	L.S.and N.Y.C.	Chicago	New York	964	22:45:00	42.38
7- 9-'85	W. Shore	Alabama	Gen. Junc.	36.3	0:30:00	72.60
6-17-'86	C., B. & Q.	Princeton	Burlington	170	2:58:00	57.3
7- 5-'86	Wabash	K. City	Peru	563	13:45:00	41
8- 8-'86	N. Y. C. & H. R.	Syracuse	Fairport	70.25	1:01:20	68.73
7-10-'88	L. & N. W.-Cal.	London	Edinboro	400	7:52:00	50.85
8- 0-'88	L. & N. W.	Crewe	Preston	51	0:50:00	61.20
8- 0-'88	L. & N. W.	Preston	Carlisle	90	1:30:00	60
8-30-'88	N. E. (Eng.)	York	Newcastle	80.5	1:18:00	62
8-31-'88	Gt. N. (Eng.)	London	Edinboro	392.5	7:26:45	52.7
4- 8-'89	C. & N. W.	Chicago	Council Bluffs	490	12:30:00	39.2
5-19-'89	P., F. W. & C.	Ft. Wayne	Chicago	148.3	2:59:00	49.7
5-26-'89	Mich. C.	S. Bridge	Chicago	511	11:41:00	43.74
3-10-'90	P & R.	Philadelphia	Jersey City	90	1:25:00	63.53
3-10-'90	P. R. R.	Jersey City	Washington	226	4:18:00	52.56
3-10-'90	P. R. R.	Washington	Jersey City	226	4:19:00	52.35
6-22-'91	N. Y. C. & H R.	New York	Buffalo	439.52	8:58:00	49.2
8- 0-'91	Canadian Pac	Vancouver	Brockville	2,792	76:31:00	36.49
9-14-'91	N. Y. C. & H. R.	New York	E. Buffalo	436.32	7:17:30	59.56
10-16-'91	N. Ry. (France)	Paris	Calais	184	3:43:00	49.51
11-28-'91	P. R. R.	Jersey City	Washington	227	4:11:00	54.22
12-22-'91	B. & O.	Philadelphia	Canton	91.6	1:41:00	54.41
3-28-'92	N. Y. C. & H. R	Oneida	De Witt	21.37	0:17:40	72.69
11-18-'92	Cent. N. J.	Fanwood	.....	1	0:00:37	97.3
11-18-'92	P. & R.	Jenkintown	L'horne	5	0:03:25	87.8
12- 0-'92	L. & N. W.	Crewe	Rugby	76	1:11:00	64.23
5- 9-'93	N. Y. C. & H. R.	Grimesville	.....	1	0:00:35	102.8
5-19-'93	N. Y. C. & H. R.	Syracuse	E. Buffalo	146	2:21:00	62.13
5-19-'93	N. Y. C. & H. R.	Looneyville	Grimesville	5	0:03:00	100
5-28-'93	N. Y. C. & H. R.	New York	Chicago	964	19:57:00	48.2
8-28-'93	L. S. & M. S. P., C., C. & St. L.	Seymour	N. Tower	42	0:35:34	70.96
3-23-'94	C. & N. W.	C. Bluffs	Chicago	488	12:52:00	41.1
4-17-'94	L. S. & M. S.	Cleveland	Erie	95.5	1:35:00	60.32
8-26-'94	A. C. Line	Jacksonville	Washington	780.8	15:49:00	49.36
4- 0-'95	C. B. & Q.	Chicago	G'burg	163	2:45:00	59.27
4-21-'95	Camden & Atl.	Camden	Atlantic City	58.3	0:45:45	76.46
8-21- 95	West Coast	London	Aberdeen	540	8:55:00	60.56
8-21-'95	East Coast	London	Aberdeen	523]	8:40:00	60.35
9-11-'95	N. Y. C. & H. R.	New York	E. Buffalo	436.32	6:51:56	63.54
9-24-'95	N. Y. C. & H. R.	Albany	Syracuse	147.84	2:10:00	68.23
10-24-'95	L. S. & M. S.	Erie	Buffalo	86	1:10:46	72.91
10-24-'95	L. S. & M. S.	Chicago	Buffalo	510.1	8:01:07	63.61
10-24-'95	P. R. R.	Jersey City	Philadelphia	89.6	1:33:21	57.6
5- 7-'96	Mich. C.	Windsor	St. Thomas	11.2	1:43:05	64.72
5- 7-'96	Mich. C.	St. Thomas	Fort Erie	118.2	1:47:15	66.13
6-10-'96	Atlantic City	Camden	Atlantic City	55.5	0:48:00	69.4
6-20-'96	Atlantic City	Camden	Atlantic City	55.5	0:57:00	58.42
7- 3-'96	C., M. & St. P.	Forest Glen	Nat. Ave.	74	1:22:00	54.2
11-21-'96	S. & R.	Weldon	Shops	76.8	1:12:30	63.56
2-15-'97	C., B. & Q.	Chicago	Denver	1,025	18:53:00	54.27
3-11-'97	Char. & Sav.	Cent. Junc.	Ashley J.	102	1:40:00	61.02

RAILROAD SPEEDS—Continued.

Month, day, year.	Railroad.	From.	To.	Dist. Miles.	Time, h. m. s.	Speed miles per H.
4- 9-'97	Atlantic Coast L.	Florence, S. C.	Rocky Mt.	172.2	3:00:00	57.70
4-21-'97	Lehigh V.	Alpine	Geneva Junc.	44	0:33:00	80.
7-14-'97	Atl. City (P. & R.)	Camden	Atlantic City	55.5	0:46:30	71.60
7-16-'97	P., Ft. W. & C.	G. R. & I. Jc	Colehour	132.5	2:15:00	58.8
8- 3-'97	Union Pacific	Evanston	Omaha	955.2	23:55:00	39.93
8- 3-'97	Union Pacific	N. Platte	Omaha	291.0	5:35:00	52.1
11-29-'97	Union Pacific	Cheyenne	Council Bluffs	519	9:19:00	55.7
12- 4-'97	Union Pacific	Sidney	Omaha	414.2	7:12:00	57.5
2-13-'98	Erie	Jersey City	Buffalo	423.	7:30:00	56.4
8-20-'98	Atlantic City	Camden	Atlantic City	55.5	0:46:45	71.2
1- 2-'99	Chic., B. & Q.	Omaha	Chicago	500.2	8:43:00	57.38
4-23-'99	Chic., B. & Q	Clyde	Burlington	197.3	3:04:00	64.33
7- 9-'99	Del., L. & W.	Bath	East Buffalo	104	1:30:00	69.30
7-19-'99	Vandalia	Clayton	Transfer	18	0:14:00	77.00
7-22-'99	Atlantic City	Camden	Atlantic City	55.5	0:51:15	65.00
7-31-'99	W. J. & S. (Penn.)	Camden	Atlantic City	58 3	0:50:30	69.30
10- 7-'99	Penn. W. Pittsburgh	Ft. Wayne	Chicago	148.3	2:50:00	52.30
10-14-'99	Wabash	Tilton	Granite City	176.6	2:47:30	63.30
11-22-'99	L. S. & M. S.	Buffalo	Cleveland	183	3:25:00	.....
3-27-'00	Atch., T. & S. F	Los Angeles	Chicago	2,236	58:00:00	38.55
4-30-'00	Chic., B. & Q.	Burlington	Chicago	205.8	3:23:00	60 80
7- 9-'00	N. Y. C. & H. R.	Rochester	Syracuse	80.7	1:25:00	56.70
7- 4-'00	Atlantic City	Camden	Atlantic City	55.5	0:44:15	75.20
8-16-'00	Atlantic City	Camden	Atlantic City	55.5	0:44:15	75.20
9-30-'00	Penn. Lines	Ft. Wayne	Clarke J.	126	2:38:00	47.90
12-21-'00	Burlington	Omaha	Billings	892.6	16:23:00	54.40
3- 1-'01	Sav., F. & W.	M. P. 69	M. P. 74	4.8	0:02:40	107.90
9- 5-'01	Mich. Cent.	Susp. Bridge	Windsor	229	3:40:00	62.45
2- 9-'02	N. Y., N. H. & H.	Harlem R.	Boston	228	4:12:00	54.30
3-24-'02	Penn.	Philadelphia	Jersey City	89.8	1:19:00	68.17
3-24-'02	Burlington	Eckley	Wray	14.8	0:09:00	98.66
6-21-'02	Penn.	Harrisburg	Altoona	131.4	2:10:00	60.70
5-25-'03	L. S. & M. S.	Toledo	Elkhart	133.4	1:54:00	70.20
6-19-'03	L. & N. W.	London	Carlisle	299.2	5:58:00	50.14
8- 8-'03	A. T. & S. F.	Chicago	Los Angeles	2,267	52:49:00	42.80
4-27-'04	Mich. Cent.	Niagara Falls	Windsor	225.7	3:18:00	68.38
6- 9-'04	Gt. Western	Plymouth	London	246.8	3:46:48	65.30
7-20-'04	Atlantic City	Camden	Atlantic City	55.5	0:43:00	77.40
5-14-'05	Atlantic City	Atlantic City	Camden	55.5	0:42:33	78.26
6- 8-'05	Penn.	E. Tolleston	Donaldson	50	0:38:00	79.00
6-13-'05	L. S. & M. S.	Chicago	Buffalo	525	7:33:00	69.53
0- 0-'05	N. Y. C. / L. S. & M. S.	New York	Chicago	964	18:00:00	53.55
7- 9-'05	A. T. & S. F.	Los Angeles	Chicago	2,246	44:54:00	50.00
10-23-'05	Southern Pac. / Union Pac. / Chic. & No. West. / L. S. & M. S. / Erie	Oakland	Jersey City	3,239	73:12:00	44.30
10-23-'05	Penn.	Crestline	Ft. Wayne	131.4	1:41:20	77.81
10-24-'05	Penn.	Crestline	Clarke J.	257.4	3:27:20	74.55
11- 3-'05	Penn.	Harrisburg	Chicago	717	12:49:00	56.00
5- 5-'06	Southern Pac. / Union Pac. / Chic & N W. / L. S. & Mich. So. / N. Y. Cent.	Oakland	New York	3,255	71:27:00	45.60
6-19-'06	Atlantic City	Camden	Atlantic City	55.5	0:43:30	76.70

*From *Locomotive Dictionary*.—Courtesy *Railroad-Age-Gazette*.

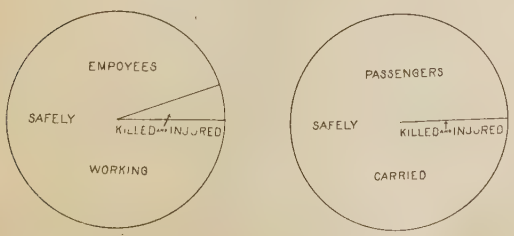
LATEST RAILROAD SPEEDS.

Month, day, year.	Railroad.	From.	To.	Dist. Miles.	Time, h. m. s.	Speed miles per H.
3-28-'09	N. Y. C. L. S.	Mott Haven	Chicago	959	16:30:00	58.12
7-29-'09	L. S. M. C.	Toledo	Elkhart	134	1:50:00	73.08
8-16-'09	C. & N. W.	Chicago	St. Paul	409	7:24:00	54.05
8-17-'09	C. & N. W.	St. Paul	Chicago	409	7:24:00	54.05
10- 2-'09	U. P.	Omaha	Denver	575	12:30:00	46.0
1-17-'10	N. Y. C. L. S.	New York	Chicago	964	18:30:00	52.1
5-21-'10	Mich. C.	Windsor	Falls View	224	3:44:00	60.0
12- 0-'10	C. of N. J.	Jersey City	Washington	227	4:04:00	55.8
2-16-'11	S. P. R. Is. N. Y. C.	Yuma	New York	2,787	74:19:00	40.41
2-28-'11	P. R.	Altoona	Philadelphia	235.1	3:29:00	67.5
2- 0-'11	P. R.	Washington	New York	226.8	3:55:30	57.8
12-22-'11	C. & N. W.	Chicago	Clinton	138	2:16:00	59.1
4-00-'11	N. Y. C.	Syracuse	Buffalo	149	2:20:00	63.84
4-00-'11	C. of N. J.	Philadelphia	Jersey City	90	1:42:00	52.9

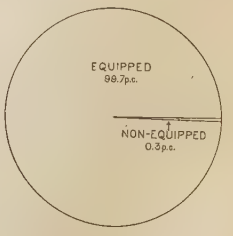
Courtesy Railroad-Age-Gazette.

RAILWAY MAIL REVENUES.

Year	Railway Mail Revenues	Number of Railway Mail Clerks	Postal Revenues
1901	38,453,602	9,105	111,631,133
1902	39,963,248	9,627	121,848,047
1903	41,709,396	10,418	134,224,443
1904	44,499,732	11,621	143,482,624
1905	45,426,125	12,474	152,826,585
1906	47,371,453	13,598	167,932,783
1907	50,378,964	14,357	183,585,006
1908	48,517,563	15,295	191,478,663
1909	49,380,783	15,866	203,562,383
1910	48,913,888	16,578	224,128,657
1911	50,092,252	16,792	237,879,823
Increase per cent	30.3	84.4	112.2



Risk of Employees and Passengers on American Railways.



Safety Appliances American Railways.

RAILWAY SPEED IN ENGLAND.

The Fastest Running, without stoppage, is made by the Companies as under:—

Company.	Train.	From	To	Time.	Distance.	Average Speed.
				H. M.	Miles.	
North Eastern	1. 8	Darlington	York	0 43	44¼	61.7
Caledonian	10. 5	Forfar	Perth	0 32	32½	60.9
Great Western	10.15	Paddington	Bristol, *via* Bath	2 0	118¼	59.1
Great Northern	4.26	Grantham	Doncaster	0 52	50½	58.2
Great Central	6.20	Marylebone	Leicester	1 52	107¼	57.6
London and South Western	3.25	Andover	Vauxhall	1 8	65	57.4
London and North Western	8.52	Willesden	Birmingham	1 53	107¼	57.0
Midland	6. 3	St. Pancras	Nottingham	2 12	123½	56.1
Lancashire and Yorkshire	11.40	Liverpool	Manchester	0 40	36½	54.8
South Eastern and Chatham	4.33	Tonbridge	Ashford	0 30	26½	53.0
Great Southern and Western	5.26	Ballybrophy	Mallow	1 28	77¾	53.0
Glasgow and South Western	2. 6	Kilmarnock	Carlisle	1 46	91½	51.8
London, Brighton & South Coast	5. 0	Victoria	Brighton	1 0	51	52.0
Great Eastern	9.50	Liverpool St.	Trowse	2 17	114	49.9
North British	2. 0	Edinburgh	Berwick	1 10	57½	49.2
Highland	11. 5	Blair-Atholl	Perth	0 51	35½	41.4

The Longest Runs without Stoppage are made by the Companies as under:—

Company	Train.	From	To	Time.	Distance	Average Speed.
				H. M.	Miles.	
Great Western	10.30	Paddington	Plymouth, *via* Westbury	4 7	225¾	54.8
London and North Western	11.15	Euston	Rhyl	3 57	209½	53.0
Midland	11.50	St. Pancras	Shipley	4 5	206	50.4
Great Northern	2.21	Wakefield	King's Cross	3 9	175¾	55.8
Great Central	3.15	Marylebone	Sheffield, *via* Aylesbury	2 57	165	55.9
Caledonian	2.17	Carlisle	Perth	3 0	150¾	50.2
Great Eastern	1.30	Liverpool St.	N. Walsham	2 38	131	49.7
North Eastern	11.17	Newcastle	Edinburgh	2 18	124½	54.1
London and South Western	4.10	Waterloo	Bourn'mo'th C.	2 6	108	51.4
North British	9.30	Edinburgh	Carlisle	2 11	98½	45.1
Glasgow and South Western	2. 4	Kilmarnock	Carlisle	1 46	91½	51.5
London, Brighton & South Coast	11.35	Clapham J'ct	Fratton	1 52	81¾	45.0
South Eastern & Chatham	9. 5	Cannon Street	Dover Pier	1 38	76½	46.2
Lancashire and Yorkshire	10.52	Huddersfield	Poulton	1 42	66	38.8

FASTEST LONG-DISTANCE TRAINS.

Railway.	From.	To.	Miles.	Speed, miles per hour.
Northern (France)	Paris	Calais	185.1	59.72
Prussian	Berlin	Hamburg	177.69	52.51
London & North West	London	Edinburgh	393.5	50.77
N. Y. C. & L. S. & M. S.	New York	Chicago	962.49	50.66
Caledonian	London	Edinburgh	401.5	50.18
P. L. & M. (France)	Paris	Mentone	687.5	49.10
Pennsylvania	New York	Chicago	897.0	47.21
Orleans (France)	Paris	Bayonne	488.0	49.3
N. Y. C. & H. R.	New York	Buffalo	440.0	49.3
O. & S. (France)	Paris	Madrid	903.0	38.49
Various	Ostend	Vienna	822.0	37.85

From the June, 1912, Railway and Locomotive Engineering.

The Loetschberg Railway Tunnel through the Bernese Alps entailed an expenditure of $20,000,000. It is nine miles long, and is therefore the third largest in Europe. It gives a direct connection with the Simplon Tunnel Railway, and shortens the route from Milan to Calais by about eighty miles.

RAILROAD ACCIDENTS.

During the year 1900 there were 2,550 employees of the railroads killed and 39,643 injured, or for every 399 men employed one was killed and for every 26 men employed one was injured. In 1909 the total number of employees killed was 2,610 and of those injured 75,006, or for each 576 men employed one man was killed and for each 20 men employed one was injured.

The total number of passengers killed during the year 1900 was 249 and of those injured 4,128, or for every 2,316,591 passengers carried one was killed and for every 139,736 carried one was injured. In 1909 253 passengers were killed and 10,311 injured, or for every 3,523,606 carried one was killed and for every 86,458 carried one was injured.

The number of other persons killed for the year 1900 was 5,066 and during 1909, 5,859; while those injured in 1900 numbered 6,549 and in 1909, 10,309. The total number of persons killed during 1900 was 7,865 and of those injured 50,320, and in 1909 total of those killed was 8,722 and of those injured 95,626.

During the year 1911 there were 110 passengers killed in train accidents. The total number of passengers carried one mile amounted to 32,837,769,000, and the number of passengers carried one mile to every one killed was 349,550,734.

During the year 1911 the railroads paid to persons on account of injuries a total amount of $25,979,747, or 0.946 per cent. of their earnings, of which amount $1,941,793 was paid as a result of the maintenance of ways; $1,806,571 because of maintenance of equipment; and $22,231,383 because of transportation.

Another loss of $33,987,746 incurred by the railroads was divided as follows: Loss and damage to freight, $24,455,611; to baggage $304,834; to property $5,051,527; to live stock, etc., $4,166,774. This amount being 1.24 per cent. of the total earnings of the railroads.

SAFETY APPLIANCES.

A comparative summary of the total equipment of the railroads and of the equipment fitted with train brakes and automatic couplers shows that, of the total equipment of 2,349,278 cars and locomotives 2,301,260 are fitted with train brakes and 2,332,837 are fitted with automatic couplers. In other words, 98 and 99.7 per cent. respectively are fitted with safety appliances.

BLOCK SIGNALS.

At the end of the year 1911, 19,995 miles of track were equipped with automatic block signals and 53,071 with non-automatic block signals, making a total of 73,066 miles (25 miles of which are equipped with both) having a block signal system of some sort. The total number of miles having a block signal system in 1910 was 71,269, thus making an increase in 1911 of 1,772 miles. Up to the present time 1,081 devices have been submitted to the Block Signal and Train Control Board for examination. Of these, apparently only one has reached a stage of practical development where with certain modifications it might "tend to promote safety upon the railroad using it."

TRAIN SERVICE.

During the year ending March 31, 1909, the steam railroads of the State of New York ran 650,592 trains or an average of 54,216 each month. During 1910 they report 703,816 trains, or 58,651 a month; and during 1911, 758,833, or 63,236 a month. For this period of three years an average of 83.4 per cent. of the trains were on time. For each train the average delay was 25.96 minutes. The principal causes of delay were: waiting for trains on other divisions, 32.6 per cent.; train work at stations, 14.3 per cent.; waiting for train connections with other railroads, 13 per cent.; trains ahead, 7.5 per cent.; engine failures, 7.1 per cent.; meeting and passing trains, 6.3 per cent.; and wrecks, 5.7 per cent.

There are 47 steamships engaged in cable laying and repairing.

SUMMARY OF CASUALTIES TO PERSONS IN RAILWAY ACCIDENTS FOR THE YEARS ENDING JUNE 30, 1911, AND 1910.

Class of Accident	1911				1910			
	Passengers		Employes		Passengers		Employes	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
Collisions	69	3,299	321	3,446	78	4,423	355	3,333
Derailments	41	2,524	253	2,108	89	2,946	253	1,868
Miscellaneous Train Accidents, including Locomotive Boiler Explosions	.....	105	75	1,843	52	142	107	1,590
Total Train Accidents	110	5,926	652	7,397	217	7,516	715	6,791
Coupling or Uncoupling Cars	.....	.....	209	2,966	.....	.....	206	2,985
While doing Other Work about Trains or while Attending Switches	.....	.....	131	18,185	.....	.....	157	18,240
Coming in Contact with Overhead Bridges, Tunnels or any Signal Apparatus or any Fixed Structure above or at the Side of the Track	5	29	77	1,517	3	33	96	1,377
Falling from Cars or Engines or while getting on or off same	131	2,749	542	13,097	137	2,833	586	13,196
Other Causes	53	3,338	1,317	4,077	64	3,374	1,623	26,029
Total (other than train accidents)	189	6,116	2,276	39,842	204	6,240	2,668	61,827
Total (all classes)	299	12,042	2,928	47,239	421	13,756	3,383	68,618
Totals in 1909	.....	.....	.....	.....	335	12,116	2,456	51,804
" " 1908	.....	.....	.....	.....	406	12,645	3,358	56,344
" " 1907	.....	.....	.....	.....	647	13,597	4,353	62,689
" " 1906	.....	.....	.....	.....	418	11,185	3,807	55,524
" " 1905	.....	.....	.....	.....	537	10,040	3,261	45,426
" " 1904	.....	.....	.....	.....	420	8,077	3,367	43,266
" " 1903	.....	.....	.....	.....	321	6,973	3,233	39,004
" " 1902	.....	.....	.....	.....	303	6,089	2,516	33,711

DENSITY OF POPULATION.

Egypt proper is the most densely populated country, having 931 per square mile. Belgium comes next with 660, then Holland. The United Kingdom has 373, Japan 336, after which come the other European Countries down to Russia with 63.7 and Sweden with 31.8. The United States has only 30.9, and the South American Republics all less. Australia contains only 1.38 persons per square mile. In England there is an average of just about 1 person per acre.

Lord Rayleigh has recently made some interesting experiments to determine the colors of the sea and sky. Other experimenters, such as Davy, Bunsen, and Spring, were all satisfied that the color of water was blue, but Lord Rayleigh's experiments have supplied only limited confirmation of that view. What appears to be the intrinsic color of the sea he finds is often due to the color of the sky or is affected by the color of the bottom. With carefully distilled water he got the same blue color of water as the water from Capri and Suez, while that from Seven Stones Lightship, off the Cornish coast, gave a full green.

CAUSE OF ACCIDENTS.

Cause of accident.	No.	Killed.	Injured.	Damage.
Broken rail	249	12	463	$292,749
Spread rail	153	4	192	102,433
Soft track	108	1	128	66,192
Bad ties	41	.....	17	18,972
Sun kink	30	3	62	51,207
Irregular track	179	5	130	122,526
Miscellaneous	465	32	568	353,381
Grand total	1,225	57	1,560	$1,007,460

KILLED IN EUROPEAN RAILWAY ACCIDENTS.

Country	Year	Passengers	Employes	Other Persons	Total	Preceding Year
United Kingdom	1910	121	420	580	1,121	1,033
Germany	1909	121	533	726	1,380	1,353
Russia	1908	237	744	1,969	2,950	2,859
France	1908	#27	300	†298	625	659
Austria	1909	34	154	125	313	279
Hungary	1909	28	136	192	356	331
Italy	1909–10	52	166	113	331	293
Spain	1907	25	64	213	302	219
Portugal	1904	.....	.....	.....	55	37
Sweden	1908	10	31	50	91	102
Norway	1909–10	1	5	7	13	12
Belgium	1909	6	46	33	85	129
Denmark‡	1909–10	2	9	19	30	26
Holland	1909	3	20	16	39	45
Switzerland	1909	12	39	25	76	90
Roumania	1908–09	13	22	53	88	100
Total		692	2,689	4,419	7,855	7,567

#In train accidents only; other accidents to passengers included under "Other Persons."
†Excluding suicides.
‡Statistics cover State railways only.

It will be observed that nearly three-fifths of the fatalities on European railways are to "other persons." As noted, passengers not killed in train accidents in France are included under the head of "other persons."

Throughout Europe it is the practice in official railway statistics to draw a sharp and clear line between those who are killed through some fault or mischance of the railway and those accidents which are the result of the person's own dereliction or carelessness—*unvorsichtige,* as the German statistics have it. Any such just distinction would relieve American railways of seven-eighths of the odium attaching to them through the publication of the quarterly Accident Bulletins.

STATISTICS OF THE PULLMAN COMPANY.

The report rendered by the Pullman Company for the year ended June 30, 1911, places the average mileage (single track) over which operations were conducted at 120,871 miles. The cost of the property and equipment required for the service amounted to $116,026,015. The operating revenues are divided into berth revenue, $31,415,913; seat revenue, $5,585,556; charter of cars, $601,498; and other miscellaneous revenues to make the total operating revenues $35,697,582. The conductors employed on the Pullman cars, 2,274 in number, receive an average daily compensation of $2.82; the 6,317 porters employed receive an average daily compensation of $1.04; and the 8 stenographers employed by the service receive an average daily compensation of $2.31.

OPERATING STATISTICS.

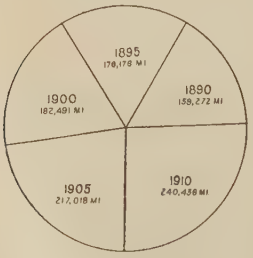
Total number of revenue passengers—berth	12,435,404
Total number of revenue passengers—seat	9,219,648
Average revenue per passenger—berth	$2.53
Average revenue per passenger—seat	$0.61
Total number of car-miles	625,589,998
Total number of car-days	1,567,916
Average number of revenue passengers per car per day	14
Operating revenues per car-mile (cents)	5.706
Operating revenues per car-day	$22.76753
Operating expenses per car-mile (cents)	4.143
Operating expenses per car-day	$16.52929
Net operating revenue per car-mile (cents)	1.563
Net operating revenue per car-day	$6.23823
Average number of car-miles per car-day	399

EQUIPMENT (OWNED OR LEASED) IN SERVICE ON JUNE 30, 1911.

Standard sleeping cars	4,155
Tourist sleeping cars	744
Parlor cars	807
Dining cars	24
Composite cars	142
Private cars	36
Miscellaneous cars	4
Total	5,912

LONG RAILWAY TUNNELS.

	Mls.	Yds.
Simplon, Switzerland-Italy	12	458
St. Gothard, Switzerland	9	564
Mont Cenis, Italy-France	7	1730
Arlberg, Austria	6	404
Hoosac, U. S. A.	4	1320
Severn, Great Western	4	624
Totley, Midland	3	950
Standedge, North Western	3	62
Woodhead, Great Central	3	17
Box, near Bath, Great Western (old)	1	1320



GROWTH OF RAILWAYS IN UNITED STATES 1890-1910

The Office of Public Roads estimates the total mileage of all public roads in the United States in 1909 at 2,199,388 and the miles of road per square mile of area at 0.74 miles. The population per mile of road, basing the road mileage of 1909 on the population of 1910, was 41. Of all the roads in the United States only 8.66 per cent. were improved in 1909.

The total estimated expenditures for public roads for the year 1911 is $142,144,191, making a total of $64.63 per mile of public road and of $1.55 per inhabitant.

EXPRESS COMPANIES.

In its Twenty-fifth Annual Report the Interstate Commerce Commission publishes a statement of the income account of express companies as reported to it for the years ending June 30, 1910, and 1911, the salient features of which are as follows:

Item	1911	1910
Number of Companies	13	13
Railway Mileage Operated	243,721	237,868
Express Operations:		
Gross Receipts from Operation	$152,555,521	$146,116,315
Less Express Privileges	73,956,450	69,917,562
Operating Revenues	$78,599,071	$76,198,753
Operating Expenses	67,070,637	61,690,473
Net Operating Revenue	$11,528,434	$14,508,280
Net Revenue from Outside Operations	13,118	10,527
Total Net Revenue	$11,541,552	$14,518,807
Taxes Accrued	1,315,201	1,126,726
Operating Income	10,226,351	13,392,081
Other Income from Investments, etc	6,309,354	5,633,792
Gross Income	16,535,706	19,025,873
Total Deductions, Interest, etc	1,168,134	1,037,316
Net corporate Income	$15,367,572	$17,988,557
Dividends Declared	5,848,082	$5,928,103

CLASSIFICATION OF MILEAGE COVERED BY OPERATIONS OF EXPRESS COMPANIES ON JUNE 30, 1911.

Name of carrier.	Total mileage.	Steam-road mileage.	Electric-line mileage.	Steamboat-line mileage.
	1911	1911	1911	1911
Total	270,666.37	243,721.41	7,291.94	18,939.65
Adams Express Co	36,560.52	32,784.94	314.58	3,438.00
American Express Co	56,877.95	54,344.00	590.70	1,919.75
Canadian Express Co	7,230.31	6,400.31	66.00	737.00
Canadian Northern Express Co	3,391.80	3,369.80	22.00	.....
Globe Express Co	2,903.63	2,903.63	.....	.....
Great Northern Express Co	8,803.54	8,466.15	197.39	140.00
National Express Co	1,640.25	1,422.25	70.00	148.00
Northern Express Co	7,625.88	7,310.48	54.00	261.00
Pacific Express Co	16,980.65	15,938.11	539.20	503.34
Southern Express Co	32,580.60	31,654.60	80.00	846.00
United States Express Co	32,748.28	28,836.99	3,444.59	466.70
Wells Fargo & Co	58,471.56	45,446.75	1,909.08	10,475.86
Western Express Co	4,851.40	4,843.40	4.00	4.00

STREET AND ELEVATED RAILWAYS: MILEAGE, NUMBER OF CARS, AND CAPITALIZATION BY STATES.

[Source: The Electric Railway Journal.]

State.	Number of companies.	Electric railways, track mileage.	Number of cars.	Capital stock.	Funded debt.
				Dollars.	*Dollars.*
Alabama	13	307.5	670	17,507,000	15,966,000
Arizona	5	57.5	41	650,000	50,000
Arkansas	10	103.8	237	5,386,800	5,934,000
California	55	2,244.5	4,068	192,559,350	141,172,000
Colorado	16	518.8	791	21,111,700	29,436,000
Connecticut	14	1,013.8	2,651	60,237,300	36,988,700
Delaware	5	48.0	81	8,350,000	4,979,008
District of Columbia	7	305.7	1,516	31,372,550	31,331,510
Florida	10	128.5	242	5,372,000	3,420,500
Georgia	14	409.0	685	23,471,000	23,823,500
Idaho	6	131.0	54	4,784,000	1,413,009
Illinois	85	3,147.9	7,810	152,594,400	292,416,340
Indiana	47	2,241.8	2,281	91,750,000	90,537,750
Iowa	30	753.8	1,177	36,595,155	32,613,000
Kansas	15	256.8	366	8,583,220	5,593,000
Kentucky	11	517.1	1,088	33,633,940	19,890,800
Louisiana	8	257.2	726	31,591,300	33,444,505
Maine	18	527.0	795	9,051,200	12,195,070
Maryland	13	6,304.0	1,961	23,161,250	70,439,800
Massachusetts	61	3,068.5	10,173	92,217,590	67,731,700
Michigan	22	1,454,9	2,636	86,885,200	57,624,000
Minnesota	9	497.0	954	25,589,000	23,138,000
Mississippi	10	106.4	163	4,462,670	5,506,500
Missouri	23	1,069.2	2,520	83,033,980	114,899,700
Montana	7	130.0	150	3,179,615	1,810,000
Nebraska	6	237.5	550	12,645,600	10,888,000
Nevada	2	10.3	12	1,042,000	135,000
New Hampshire	20	282.0	384	6,407,200	4,008,005
New Jersey	49	1,311.0	2,689	84,589,490	89,404,380
New Mexico	2	10.5	11	400,000	225,000
New York	146	4,689.0	17,608	514,923,222	482,896,250
North Carolina	12	135.2	247	19,044,400	10,579,700
North Dakota	3	22.5	59	440,000	200,000
Ohio	91	4,127.0	5,767	200,462,940	126,562,140
Oklahoma	17	197.0	256	7,205,300	5,128,500
Oregon	9	420.6	1,195	43,290,000	38,432,000
Pennsylvania	242	4,343.3	8,915	280,456,012	210,210,729
Rhode Island	9	442.2	1,173	31,585,100	16,426,700
South Carolina	6	118.5	176	6,300,700	4,146,000
South Dakota	3	19.5	23	600,000	200,000
Tennessee	11	349.4	820	19,949,900	25,421,000
Texas	36	624.2	1,044	29,597,000	20,930,000
Utah	6	237.8	297	8,237,500	6,996,000
Vermont	10	97.0	151	4,380,800	3,476,000
Virginia	21	451.3	885	23,547,537	34,394,100
Washington	19	936.2	1,960	50,878,200	40,968,000
West Virginia	19	356.2	518	13,500,800	13,077,500
Wisconsin	26	735.7	1,011	22,323,000	35,084,900
Wyoming	1	5.0	14	75,000	.....
Total, 1910	1,279	40,088.0	89,601	2,380,011,921	2,302,094,296

*The net capital liability of the Canadian railways, exclusive of Government owned roads, in 1911 was $1,398,089,701 or $55,829 per mile, which is far below their "capital cost."

In 1911 the railways of Canada paid $1,792,390. In Nova Scotia and New Brunswick they are exempt from taxation.

RAILWAYS OF CANADA,

Statistics of the Railways of the Dominion for the Years Ending June 30, 1908, 1910 and 1911.

	1908	1910	1911
Miles of Line Operated	22,966	24,731	25,400
Second Track	1,211	1,543	1,610
Yard Track and Sidings	4,546	5,155	5,550
All Tracks	28,723	31,429	32,560
Capital Cost*			
Stock	$607,425,349	$687,557,387	$749,207,687
Funded Debt	631,869,664	722,740,300	779,481,514
Government Railways	109,423,104	118,018,751	119,615,666
Subsidies	166,291,482	190,753,063	202,179,254
Total Capital Cost	$1,515,009,599	$1,719,069,501	$1,850,484,121
Per Mile of Line	65,968	69,513	72,854
Passenger Traffic			
Passengers Carried	34,044,992	35,894,575	37,097,718
Passengers Carried 1 Mile	2,081,960,864	2,466,729,664	2,605,968,924
Average Journey (miles)	61	69	70
Average Passengers per Train	54	59	60
Mileage of Passenger Trains	31,950,349	35,022,541	36,985,911
Mileage of Mixed Trains	6,210,807	6,441,440	6,277,468
Receipts from Passengers	$39,992,503	$46,018,880	$50,566,894
Receipts per Passenger Mile (cents)	1.920	1.866	1.944
Freight Traffic			
Tons Carried	63,019,900	74,482,866	79,884,282
Tons Carried 1 Mile	12,961,512,519	15,712,127,701	16,048,478,295
Average Haul (miles)	206	211	200
Freight Train Mileage	40,476,370	50,184,108	50,498,866
Average Tons per Train	278	311	305
Receipts from Freight	$93,746,655	$116,229,894	$124,743,015
Receipts per Ton Mile (mills)	7.23	7.39	7.77
Miscellaneous Receipts	$13,179,155	$11,707,443	$13,423,585
Total Receipts	146,918,313	173,956,217	188,733,493
Expenses of Operation			
Way and Structures	$20,778,610	$27,035,603	$29,245,093
Maintenance of Equipment	20,273,626	26,002,301	26,127,638
Traffic Expenses		4,366,177	4,831,744
Conducting Transportation	62,486,270	58,928,171	66,343,270
General Expenses	3,765,636	4,073,188	4,487,039
Total Expenses	$107,304,142	$120,405,440	$131,034,784
Ratio to Earnings	73.04%	69.2%	69.44%
Net Receipts	$39,614,171	$53,550,776	$57,698,709
Percentage to Capital Cost	2.61%	3.12%	3.12%
Gross Receipts per Mile	$6,398	$7,033	$7,430
Gross Expense per Mile	4,672	4,868	5,158
Number of Employes	106,404	123,768	141,224
Compensation	$60,376,607	$67,167,793	$74,613,738
Proportion of Gross Earnings	41.10%	38.82%	39.53%
Proportion of Operating Expenses	56.27%	55.78%	56.94%
Average per Employe per Year	$569	$503	$528

CANADIAN RAILWAYS.

ACCIDENTS, ELECTRIC RAILWAYS.—In 1910 the killed numbered 14 passengers, 13 employees, 68 others; total 95. Injured, 1,595 passengers, 227 employees, 716 others; total 2,538.

ACCIDENTS, STEAM RAILWAYS, 1910.—Passengers, 60 killed, 270 injured; employees, 214 and 926; trespassers, 175 and 148; non-trespassers, 74 and 77; postal clerks, 1 and 20. Total killed, 524; injured, 1,441.

CAPITAL INVESTED IN CANADIAN STEAM RAILWAYS.—In 1910 the total capital invested in Steam Railways was: $1,410,297,687 composed of shares, $687,557,387, and funded debt, $722,740,300; in Electric Railways, $102,044,979, including shares $58,653,826, and funded debt, $43,391,153.

EARNINGS of STEAM RAILWAYS.—Net earnings for all railways in 1910, $53,550,776; operating expenses, $120,405,440.

ELECTRIC RAILWAY STATISTICS.—In 1910, paid-up capital invested, $102,044,979; mileage, 1,047; gross earnings, $17,100,789; operating expenses, $10,121,781. Net earnings, $5,383,276. Passengers carried, 237,655,074. Freight carried, 852,204 tons.

EXPRESS AND TELEGRAPH COMPANIES.—The Dominion Express Co. and the C. P. R. Telegraph operate along the lines of the Canadian Pacific Ry. The Canadian Northern Express Co. and the Canadian Northern Telegraph Co. along the lines of the Canadian Northern Ry., and the Canadian Express Co. (Pres., Chas. M. Hays; Vice-Pres., James Bryce), with the Great North-Western Telegraph Co., operates along the lines of the G. T. Ry. This, the first Express Co. in Canada, was founded as the British N. America Co. in 1854, and reorganized in 1865.

GRAND TRUNK PACIFIC.—The main line, Moncton, N. B., to Prince Rupert, B. C., with 3,560 miles, will be entirely on Canadian soil, forming a link on the proposed All-Red Route. The line between Winnipeg and Edson, 923 miles, also also between Westfort and Lake Superior Junction, 189 miles, is completed. The section between Winnipeg and Lake Superior Junction is also nearing completion. This will give a continuous track from Port Arthur and Ft. William to Edson, 1,370 miles. Construction easterly from Prince Rupert was begun early in 1908, and steel has been laid on 100 miles of completed grade, and will be laid a distance of 140 miles more before the close of 1911. Commercial telegraph service of G. T. P. Tel. Co. now in operation between Winnipeg and Edmonton, Alta., 792 miles. Branch lines contemplated aggregate 5,000 miles. The G. T. P. will operate Atlantic, Pacific and Lake fleets of steamers. A new daily passenger service was inaugurated between Winnipeg and Edmonton, in July, 1910, with standard sleeping cars, parlor-library, café car, and modern day coaches.

HUDSON BAY ROUTE.—From varied expert opinions, optimistic and the reverse, it may be fairly concluded that the route is open for navigation from about 15th July to about 15th October. The Canadian Northern Railway have built a line from Winnipeg to the Pas on the Saskatchewan River. From there to Fort Churchill the distance is 465 miles; to Port Nelson, 397 miles. This route will effect an average shortening of the distance from the Western wheat fields to the Atlantic seaboard of 970 miles. The distance to Liverpool from Churchill is 2,946 miles, from Montreal via Belle Isle 2,761, and via Cape Race, 2,927 miles, from New York 3,079 miles. The freight upon grain from the wheat belt to Hudson Bay would approximate 10 cents a bushel, a saving of 15 cents on carriage to the Atlantic seaboard, or $3,000,000 annually on an export trade of 20 million bushels via this route. On cattle shipments from Calgary there would be effected a saving in freight of 60 cents per 100 lbs., as well as a saving in deterioration. The entrance to the harbor at Fort Churchill is about 2,000 ft. wide, with a minimum depth of 10 fathoms. More dredging would have to be done at Port Nelson than Ft. Churchill, but reports of the Hudson's Bay Co., 1824 to 1894, show that on an average Ft. Churchill harbor is open 5 months, and Port Nelson 7 months in the year. Write for pamphlet, "The Hudson Bay Route," to the Department of the Interior, Ottawa. See Report Department of Railways and Canals, 1909. For resources of Hudson Bay District, see under Agriculture, Agricultural Lands, Mining and Forests.

MILEAGE STEAM RAILWAYS IN OPERATION.—16 miles in 1836, date of first railway; 16 in 1846; 1,414 in 1856; 2,278 in 1866; 5,218 in 1876; 11,793 in 1886; 16,270 in 1896; 21,353 in 1906; 22,452 in 1907; 22,966 in 1908; 24,104 in 1909; 24,731 in 1910.

TRAFFIC STEAM RAILWAYS.—In 1875 there were carried 5,190,416 passengers and 5,670,837 tons of freight (2,000 lbs.). In 1885, 9,672,599 and 14,659,271; in 1895, 13,987,580 and 21,524,421; in 1906, 27,989,782 and 57,966,713; in 1907, 32,137, 319 and 63,866,135; in 1908, 34,044,992 and 63,071,167; in 1909, 32,688,309 and 66,842,258; and in 1910, 35,895,575 passengers and 74,482,866 tons of freight.

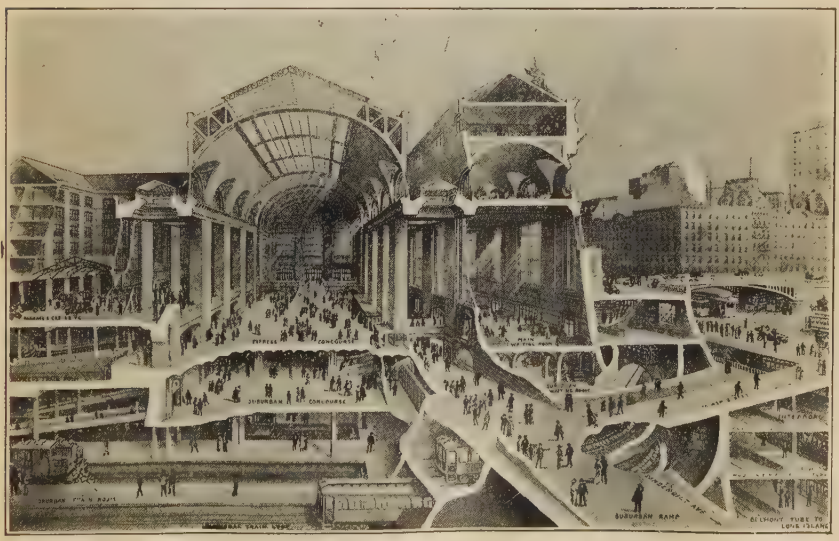
NATIONAL TRANSCONTINENTAL RAILWAY.—Under agreements dated 29th July 1903, and 18th February, 1904, ratified by Parliament the Grand Trunk Pacific Co. agreed in respect of the construction of a railway between Moncton, N. B., and Port Simpson, or some other port in B. C.—the eastern division, from Winnipeg to Moncton, to be constructed by the Dominion Government under four Commissioners, and leased for 50 years at a rental of 3 per cent. on cost of construction, the first 7 years to be free; the western division, from Winnipeg to Prince Rupert, B. C., to be constructed by the company. The Government to guarantee the company's bonds sufficient to meet cost of construction, such not to exceed $13,000 per mile on the prairie section. The entire line between Winnipeg and Moncton, 1,804.84 miles, is under contract. The work between Winnipeg and Moncton, N. B., is well under way, and the section between Winnipeg and Lake Superior Junction is open for operation. The total expenditure by the Commission up to 31st March, 1911, amounted to $95,406,697.61. See also under Grand Trunk Pacific. For Commissioner and Chief Officers see Heaton's Annual under Official Directory.

QUEBEC BRIDGE.—It is expected that the new bridge on the I. C. R. across the St. Lawrence River near Quebec will be ready for traffic in 1915. The contract has been let to the St. Lawrence Bridge Co., a Canadian concern. Total estimated cost, $12,000,000. The length of the central span is to be 1,800 ft., 90 ft. longer than the span of the Forth bridge, total length 3,228 ft., width 88 ft. The bridge will accommodate a double-track railway, and has a 4 ft. footpath on each side. This is the largest cantilever bridge in the world. Write Sec. Rys. and Canals, Ottawa.

PENNSYLVANIA RAILROAD'S NEW TERMINAL.

During the first year, ending November 27, 1911, the Pennsylvania Railroad's New Terminal in New York City sold 1,929,320 tickets. Trains to the number of 111,942 passed in and out of the station and of this number 99 per cent. were on time. There were 1,500,000 pieces of baggage handled. The number of telephone calls was 377,714 and the taxicabs called numbered 230,197.

The Pennsylvania-Hudson-Manhattan rapid transit service between New York City and Newark commenced operation November 26, 1911.



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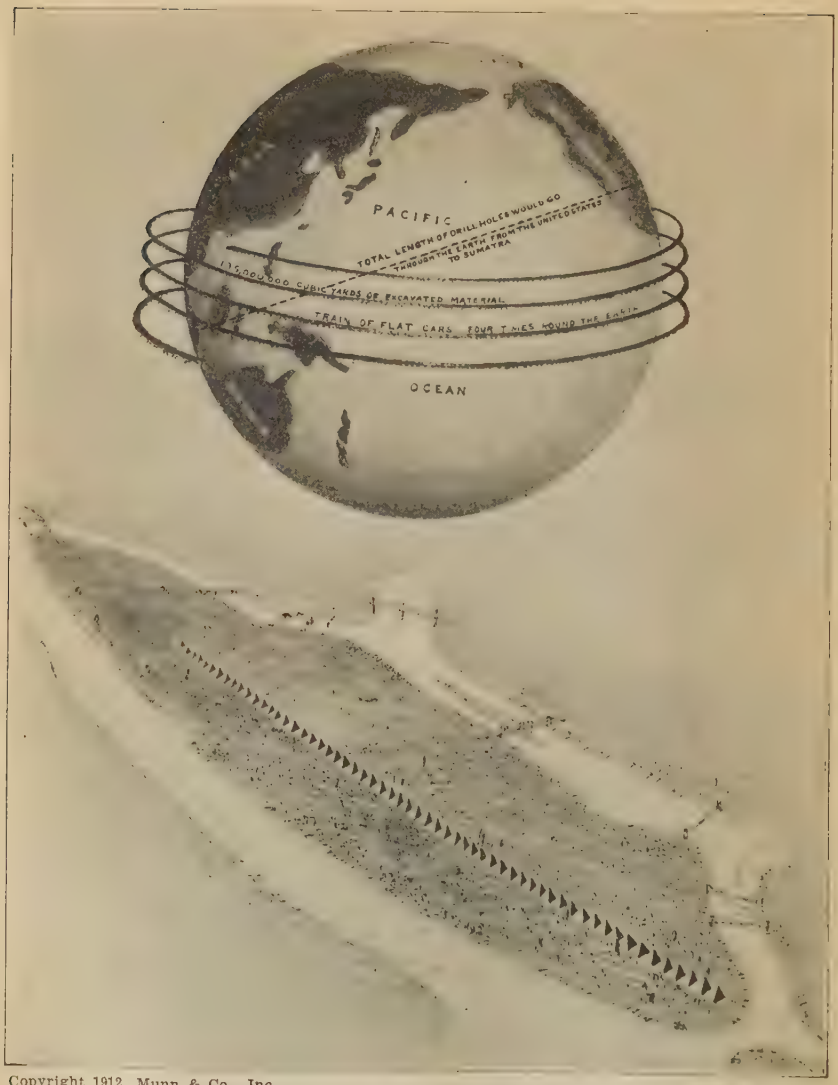
NEW GRAND CENTRAL TERMINAL, NEW YORK CITY.


PACIFIC
TOTAL LENGTH OF DRILL HOLES WOULD GO
THROUGH THE EARTH FROM THE UNITED STATES
TO SUMATRA
195,000,000 CUBIC YARDS OF EXCAVATED MATERIAL
TRAIN OF FLAT CARS FOUR TIMES ROUND THE EARTH
OCEAN

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COMPARISON SHOWING THE HUGE AMOUNT OF EXCAVATION FOR COMPLETED PANAMA CANAL.

The total of 195,000,000 cubic yards would build about 8 miles of Pyramids each of the size of Great Pyramid of Cheops. Loaded on flat cars it would represent a train 96,000 miles in length.

CHAPTER VIII.

THE PANAMA CANAL.

Compiled by the Secretary of the Isthmian Canal Commission.

The entire length of the Panama Canal from deep water in the Atlantic to deep water in the Pacific is about 50 miles. Its length from shore-line to shore-line is about 40 miles. In passing through it from the Atlantic to the Pacific, a vessel will enter the approach channel in Limon Bay, which will have a bottom width of 500 feet and extend to Gatun, a distance of about seven miles. At Gatun, it will enter a series of three locks in flight and be lifted 85 feet to the level of Gatun Lake. It may steam at full speed through this lake, in a channel varying from 1,000 to 500 feet in width, for a distance of about 24 miles, to Bas Obispo, where it will enter the Culebra Cut. It will pass through the Cut, a distance of about nine miles, in a channel with a bottom width of 300 feet, to Pedro Miguel. There it will enter a lock and be lowered 30½ feet to a small lake, at an elevation of 54⅔ feet above sea level, and will pass through this for about 1½ miles to Miraflores. There it will enter two locks in series and be lowered to sea level, passing out into the Pacific through a channel about 8½ miles in length, with a bottom width of 500 feet. The depth of the approach channel on the Atlantic side, where the maximum tidal oscillation is 2½ feet, will be 41 feet at mean tide, and on the Pacific side, where the maximum oscillation is 21 feet, the depth will be 45 feet at mean tide.

Throughout the first 16 miles from Gatun, the width of the Lake channel will be 1,000 feet; then for 4 miles it will be 800 feet, and for 4 miles more to the northern entrance of Culbra Cut at Bas Obispo, it will be 500 feet. The depth will vary from 85 to 45 feet. The water level in the Cut will be that of the Lake, the depth 45 feet, and the bottom width of the channel 300 feet.

Three hundred feet is the minimum bottom width of the Canal. This width begins about half a mile above Pedro Miguel locks and extends about 8 miles through Culebra Cut, with the exception that at all angles the channel is widened sufficiently to allow a thousand-foot vessel to make the turn. The Cut has eight angles, or about one to every mile. The 300-foot widths are only on tangents between the turning basins at the angles. The smallest of these angles is 7° 36′ and the largest 30°.

In the whole Canal there are 22 angles, the total curvature being 600° 51′. Of this curvature, 281° 10′ are measured to the right, going south, and 319° 41′ to the left. The sharpest curve occurs at Tabernilla, and is 67° 10′.

GATUN DAM.

The Gatun Dam, which will form Gatun Lake by impounding the waters of the Chagres and its tributaries, will be nearly 1½ miles long, measured on its crest, nearly ½ mile wide at its base, about 400 feet wide at the water surface, about 100 feet wide at the top, and its crest as planned, will be at an elevation of 115 feet above mean sea level, or 30 feet above the normal level of the Lake. Of the total length of the Dam only 500 feet, or 1/15, will be exposed to the maximum water head of 85 feet. The interior of the Dam will be formed of a natural mixture of sand and clay, dredged by hydraulic process from pits above and below the Dam, and placed between two large masses of rock and miscellaneous material obtained from steam shovel excavation at various points along the Canal. The top and upstream slope will be thoroughly riprapped. The entire Dam will contain about 21,000,000 cubic yards of material.

The Spillway is a concrete lined opening, 1,200 feet long and 300 feet wide, cut through a hill of rock nearly in the center of the Dam, the bottom of the opening being 10 feet above sea level. It will contain about 225,000 cubic yards of concrete. During the construction of the Dam, all the water discharged from the Chagres and its tributaries flowed through this opening. Construction has now advanced sufficiently to permit the Lake to be formed, and the Spillway has been closed with a concrete dam, which is being fitted with gates and machinery for regulating the water level of the Lake.

WATER SUPPLY OF GATUN LAKE.

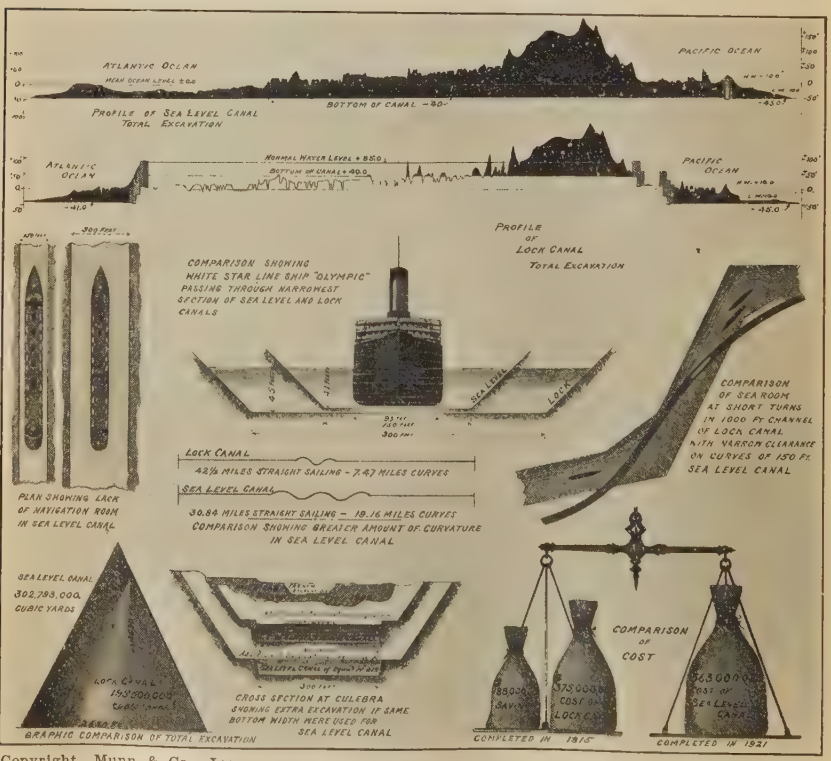
Gatun Lake will impound the waters of a basin comprising 1,320 square miles. When the surface of the water is at 85 feet above sea level, the Lake will have an area of about 164 square miles, and will contain about 206 billion cubic feet of water. During eight or nine months of the year, the lake will be kept constantly full by the prevailing rains, and consequently a surplus will need to be stored for only three or four months of the dry season. The smallest run-off of water in the basin, during the past 21 years, as measured at Gatun, was about 146 billion cubic feet. In 1910 the run-off was 360 billion cubic feet, or a sufficient quantity to fill the lake one and a half times. The water surface of the Lake will be maintained during the rainy season at 87 feet above sea level, making the minimum channel depth in the Canal 47 feet. As navigation can be carried on with about 41 feet of water, there will be stored for dry

season surplus over five feet of water. Making due allowance for evaporation, seepage, leakage at the gates, and power consumption, this would be ample for 41 passages daily through the locks, using them at full length, or about 58 lockages a day when partial length is used, as would usually be the case, and when cross filling from one lock to the other through, the central wall is employed. This would be a larger number of lockages than would be possible in a single day. The average number of lockages through the Sault Ste. Marie Canal on the American side was 37 per day in the season of navigation of 1909, which was about eight months long. The average number of ships passed was about 1½ per lockage. The freight carried was more than 30,000,000 tons. The Suez Canal passed about 12 vessels per day, with a total tonnage for the year of 15,500,000.

DAMS ON PACIFIC SIDE.

The water level of Gatun Lake, extending through the Culebra Cut, will be maintained at the south end by an earth dam connecting the locks at Pedro Miguel with the high ground to the westward, about 1,400 feet long, with its crest at an elevation of 105 feet above mean tide. A concrete core wall, containing about 700 cubic yards, will connect the locks with the hills to the eastward; this core wall will rest directly on the rock surface and is designed to prevent percolation through the earth, the surface of which is above the Lake level.

A small lake between the locks at Pedro Miguel and Miraflores will be formed by dams connecting the walls of Miraflores locks with the high ground on either side. The dam to the westward will be of earth, about 2,700 feet long, having its crest about 15 feet above the water in Miraflores Lake. The east dam will be of concrete, containing about 75,000 cubic yards; will be about 500 feet long, and will form a spillway for Miraflores Lake, with crest gates similar to those at the Spillway of the Gatun Dam.


ATLANTIC OCEAN
PACIFIC OCEAN
PROFILE OF SEA LEVEL CANAL
TOTAL EXCAVATION
BOTTOM OF CANAL -30'
NORMAL WATER LEVEL +85.0
BOTTOM OF CANAL +40.0
PROFILE OF LOCK CANAL
TOTAL EXCAVATION
COMPARISON SHOWING WHITE STAR LINE SHIP "OLYMPIC" PASSING THROUGH NARROWEST SECTION OF SEA LEVEL AND LOCK CANALS
SEA LEVEL
LOCK
COMPARISON OF SEA ROOM AT SHORT TURNS IN 1000 FT CHANNEL OF LOCK CANAL WITH VARROW CLEARANCE ON CURVES OF 150 FT. SEA LEVEL CANAL
PLAN SHOWING LACK OF NAVIGATION ROOM IN SEA LEVEL CANAL
LOCK CANAL
42½ MILES STRAIGHT SAILING - 7.47 MILES CURVES
SEA LEVEL CANAL
30.84 MILES STRAIGHT SAILING - 19.16 MILES CURVES
COMPARISON SHOWING GREATER AMOUNT OF CURVATURE IN SEA LEVEL CANAL
SEA LEVEL CANAL
302,793,000 CUBIC YARDS
LOCK CANAL
153,500,000 CUBIC YARDS
GRAPHIC COMPARISON OF TOTAL EXCAVATION
CROSS SECTION AT CULEBRA SHOWING EXTRA EXCAVATION IF SAME BOTTOM WIDTH WERE USED FOR SEA LEVEL CANAL
COMPARISON OF COST
88,000,000 SAVED
375,000,000 COST OF LOCK CANAL
COMPLETED IN 1915
COMPLETED IN 1921

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DIAGRAMMATIC COMPARISON SHOWING SUPERIORITY OF LOCK CANAL TO ONE AT SEA LEVEL.

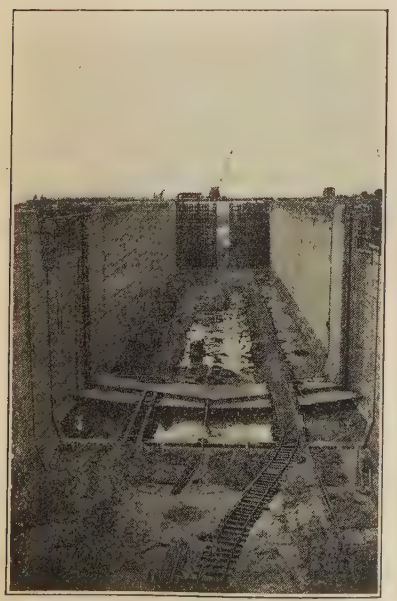
THE LOCKS.

There will be 6 double locks in the Canal; three pairs in flight at Gatun, with a combined lift of 85 feet; one pair at Pedro Miguel, with a lift of 30⅛ feet, and two pairs at Miraflores, with a combined lift of 54⅜ feet at mean tide. The usable dimensions of all are the same—a length of 1,000 feet, and width of 110 feet. Each lock will be a chamber, with walls and floor of concrete, and mitering gates at each end.

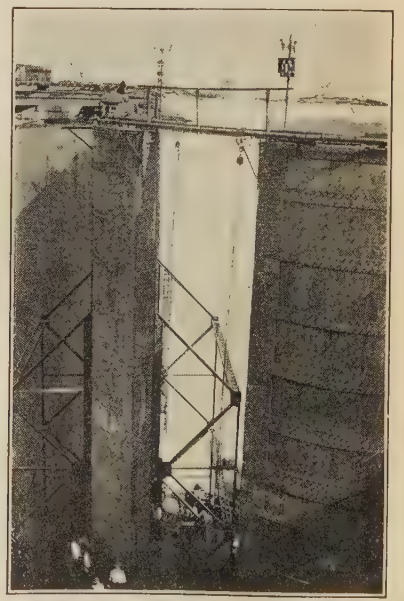
The side walls will be 45 to 50 feet wide at the surface of the floor; will be perpendicular on the face, and will narrow from a point 24½ feet above the floor until they are 8 feet wide at the top. The middle wall will be 60 feet wide, approximately 81 feet high, and each face will be vertical. At a point 42½ feet above the surface of the floor, and 15 feet above the top of the middle culvert, this wall will divide into two parts, leaving a space down the center much like the letter "U," which will be 19 feet wide at the bottom and 44 feet wide at the top. In this center space will be a tunnel divided into three stories, or galleries. The lowest gallery will be for drainage; the middle, for the wires that will carry the electric current to operate the gate and valve machinery installed in the center wall, and the upper will be a passageway for the operators.

The lock gates will be steel structures 7 feet thick, 65 feet long, and from 47 to 82 feet high. They will weigh from 300 to 600 tons each. Ninety-two leaves will be required for the entire Canal, the total weighing 57,000 tons. Intermediate gates will be used in the locks, in order to save water and time, if desired, in locking small vessels through, the gates being so placed as to divide the locks into chambers 600 and 400 feet long, respectively. Ninety-five per cent. of the vessels navigating the high seas are less than 600 feet long. In the construction of the locks, which are now practically completed, it is estimated that there has been used approximately 4,200,000 cubic yards of concrete, requiring about the same number of barrels of cement.

Electricity will be used to tow all vessels into and through the locks, and to operate all gates and valves, power being generated by water turbines from the head created by Gatun Lake. Vessels will not be permitted to enter or pass through the locks under their own power, but will be towed through by electric locomotives running on cog-rails laid on the tops of the lock walls. There will be two towing tracks for each flight of locks, one on the side and one on the middle wall. On each side wall there will be one return track and on the middle wall a third common to both of the twin locks. All tracks will run continuously the entire length of the respective flights and will extend some distance on the guide approach walls at each end. The number of locomotives used will vary with



LOOKING THROUGH ONE OF THE GATUN LOCKS.
Width, 110 feet; length of one chamber, 1000 feet.



LOCK GATES AT GATUN LOCKS.
7 feet thick and 76 feet high.

the size of the vessel. The usual number required will be four; two ahead, one on each wall, imparting motion to the vessel, and two astern, one on each wall, to aid in keeping the vessel in a central position and to bring it to rest when entirely within the lock chamber. They will be equipped with a slip drum, towing windlass and hawser which will permit the towing line to be taken in or paid out without actual motion of the locomotive on the track.

The locks will be filled and emptied through a system of culverts. One culvert 254 sq. ft. in area of cross section, about the area of the Hudson River tunnels of the Pennsylvania Railroad, extends the entire length of each of the middle and side walls and from each of these large culverts there are several smaller culverts, 33 to 44 sq. ft. in area, which extend under the floor of the lock and communicate with the lock chamber through holes in the floor. The large culverts are controlled at points near the miter gates by large valves and each of the small culverts extending from the middle wall culvert into the twin chambers is controlled by a cylindrical valve. The large culvert in the middle wall feeds in both directions through laterals, thus permitting the passage of water from one twin lock to another, effecting a saving of water.

To fill a lock the valves at the upper end are opened and the lower valves closed. The water flows from the upper pool through the large culverts into the small lateral culverts and thence through the holes in the floor into the lock chamber. To empty a lock the valves at the upper end are closed and those at the lower end are opened and the water flows into the lower lock or pool in a similar manner. This system distributes the water as evenly as possible over the entire horizontal area of the lock and reduces the disturbance in the chamber when it is being filled or emptied.

The depth of water over the miter sills of the locks will be 40 feet in salt water and 41⅛ feet in fresh water.

The average time of filling and emptying a lock will be about fifteen minutes, without opening the valves so suddenly as to create disturbing currents in the locks or approaches. The time required to pass a vessel through all the locks is estimated at 3 hours; one hour and a half in the three locks at Gatun, and about the same time in the three locks on the Pacific side. The time of passage of a vessel through the entire Canal is estimated as ranging from 10 to 12 hours, according to the size of the ship, and the rate of speed at which it can travel.

EXCAVATION.

The total excavation, dry and wet, for the Canal, as originally planned, was estimated at 103,795,000 cubic yards, in addition to the excavation by the French companies. Changes in the plan of the Canal, made subsequently by order of the President, increased the amount to 174,666,594 cubic yards. Of this amount, 89,794,493 cubic yards were to be taken from the Central Division, which includes the Culebra Cut. In July, 1910, a further increase of 7,871,172 cubic yards was made, of which 7,330,525 cubic yards were to allow for slides in Culebra Cut, for silting in the Chagres section, and for lowering the bottom of the Canal from 40 to 39 feet above sea level in the Chagres section. These additions increased the estimated total excavation to 182,537,766 cubic yards. The present estimate is 195,000,000 cubic yards. Active excavation work on a large scale did not begin until 1907, when 15,765,290 cubic yards were removed. In 1908, over 37,000,000 cubic yards were removed, and in 1909, over 35,000,000, making a total for the two years of over 72,000,000 cubic yards, or a monthly average for those two years of 3,000,000 cubic yards. In 1910, over 31,000,000 cubic yards were removed, the monthly average exceeding 2,600,000 cubic yards. The total for these three years was nearly three-fifths of the entire excavation for the Canal. Records of all excavation to May 1, 1911, are appended:

By French Companies		78,146,960
French excavation useful to present Canal		29,908,000
By Americans—		
Dry excavation	84,112,947	
Dredges	50,976,485	
		135,089,432
May 4 to December 31, 1904	243,472	
January 1 to December 31, 1905	1,799,227	
January 1 to December 31, 1906	4,948,497	
January 1 to December 31, 1907	15,765,290	
January 1 to December 31, 1908	37,116,735	
January 1 to December 31, 1909	35,096,166	
January 1 to December 31, 1910	31,437,677	
January 1 to May 1, 1911	11,343,456	

SLIDES.

In 1911 there were in all twenty-one slides along the Culebra Cut. Twelve covered areas varying from one to forty-seven acres, and nine covered areas of less than one acre each, making in all a total of one hundred and forty-nine acres. The largest is the Cucaracha slide, on the east side of the Canal, which covers an area of forty-seven acres, and which has broken back 1,820 feet from the center line of the Canal. This slide, according to French records, started as early as 1884, and has given the Americans considerable trouble since they began work. Over two million cubic yards have been removed by the Americans, but the slide is now "dead." The next largest slide is a combination of two slides on the west side of the Cut at Culebra, just north of Contractor's Hill, covering about twenty-eight acres. In 1911 over two million cubic yards had been removed from this slide, and it was estimated that one million cubic yards were still in motion. On the east side of the Cut, north of Gold Hill, was another large slide covering an area of about seventeen acres which had broken back 1,200 feet from the center line of the Canal. Over 416,000 cubic yards had been taken out

Courtesy of "The Sphere."

WHERE CANAL MEETS ATLANTIC.

Limon Bay is on the right, through which the extended canal entrance leads to the Atlantic Ocean on the left.

of this slide and about three-quarters of a million more were in motion. The total distance across the Cut at this point from back to back of slides was 1,950 feet. Over nine million cubic yards have been taken out since July, 1905, because of slides, and over three million cubic yards are still in motion.

CAPACITY OF STEAM SHOVELS AND DIRT TRAINS.

There are several classes of steam shovels engaged in excavating work, equipped with dippers ranging in capacity from 1¾ cubic yards to 5 cubic yards, and a trenching shovel, which has a dipper with a capacity of ¾ of a cubic yard.

Each cubic yard, place measurement, of average rock weighs about 3,900 pounds; of earth, about 3,000 pounds; of "the run of the cut," about 3,600 pounds, and is said to represent about a two-horse cart load. Consequently, a five cubic yard dipper, when full, carries 8.7 tons of rock, 6.7 tons of earth, and 8.03 tons of "the run of the cut."

Three classes of cars are used in hauling spoil—flat cars with one high side, which are unloaded by plows operated by a cable upon a winding drum, and two kinds of dump cars, one large and one small. The capacity of the flat cars is 19 cubic yards; that of the large dump cars, 17 cubic yards, and that of the small dump cars, 10 cubic yards. The flat car train is ordinarily composed of 20 cars in hauling from the cut at Pedro Miguel, and of 21 cars in hauling from the cut at Matachin. The large dump train is composed of 27 cars, and the small dump train of 35 cars.

The average load of a train of flat cars, in hauling the mixed material known as "the run of the cut," is 610.7 tons (based on a 20-car train); of a train of large dump cars, 737.68 tons, and of a train of small dumps, 562.5 tons.

The average time consumed in unloading a train of flat cars is from 7 to 15 minutes; in unloading a train of large dump cars, 15 to 40 minutes; and in unloading a train of small dump cars, 6 to 56 minutes. The large dump cars are operated by compressed air power furnished by the air pump of the locomotive, while the small dump cars are operated by hand.

The record day's work for one steam shovel was that of March 22, 1910, 4,823 cubic yards of rock (place measurement), or 8,395 tons. The highest daily record in the Central Division was on March 11, 1911, when 51 steam shovels and 2 cranes equipped with orange peel buckets excavated an aggregate of 79,484 cubic yards, or 127,742 tons. During this day, 333 loaded trains and as many empty trains were run to and from the dumping grounds.

BREAKWATERS.

Breakwaters are under construction at the Atlantic and Pacific entrances of the Canal. That in Limon Bay, or Colon harbor, extends into the bay from Toro Point at an angle of 42 degrees and 53 minutes northward from a base line drawn from Toro Point to Colon light, and will be 10,500 feet in length, or 11,700 feet, including the shore connection, with a width at the top of fifteen feet and a height above mean sea level of ten feet. The width at the bottom will depend largely on the depth of water. It will contain approximately 2,840,000 cubic yards of rock, the core being formed of rock quarried on the mainland near Toro Point, armored with hard rock from Porto Bello. Work began on the breakwater in August, 1910, and on May 1, 1911, the fill had been extended 4,214 feet. The estimated cost is $5,500,000. A second breakwater has been proposed for Limon Bay, but this part of the project has not been formally acted upon. The purpose of the breakwaters is to convert Limon Bay into a safe anchorage, to protect shipping in the harbor of Colon, and vessels making the north entrance to the Canal, from the violent northers that are likely to prevail from October to January, and to reduce to a minimum the amount of silt that may be washed into the dredged channel.

The breakwater at the Pacific entrance will extend from Balboa to Naos Island, a distance of about 17,000 feet, or a little more than three miles. It will lie from 900 to 2,700 feet east of and for the greater part of the distance nearly parallel to the axis of the Canal prism; will vary from 20 to 40 feet in height above mean sea level, and will be from 50 to 3,000 feet wide at the top. It is estimated that it will contain about 18,000,000 cubic yards of earth and rock, all of which will be brought from Culebra Cut. It is constructed for a two-fold purpose; first, to divert cross currents that would carry soft material from the shallow harbor of Panama into the Canal channel; second, to insure a more quiet harbor at Balboa. Work was begun on it in May, 1908. On May 1, 1911, it had been constructed for a distance of 13,000 feet.

CANAL FORCE, QUARTERS AND SUPPLIES.

The Canal force is recruited and housed by the Quartermaster's Department which has two general branches, labor and quarters, and material and supplies. Through the labor and quarters branch there have been brought to the Isthmus 43,432 laborers, of whom 11,797 came from Europe, 19,448 from Barbados, the balance from other islands in the West Indies and from Colombia. No recruiting is required at present, the supply of labor on the Isthmus being ample.

On May 1, 1911, the total force of the Isthmian Canal Commission and Panama Railroad Company, actually at work, was divided as follows:

	Gold	Silver	Total
Isthmian Canal Commission	4,540	23,592	28,132
Panama Railroad Company (proper)	467	3,639	4,106
Panama Railroad Relocation	121	2,201	2,322
Panama Railroad Commissary	219	800	1,019
Totals	5,347	30,232	35,579

The gold force is made up of the officials, clerical force, construction men, and skilled artisans of the Isthmian Canal Commission and the Panama Railroad Company. Practically all of them are Americans. The silver force represents the unskilled laborers of the Commission and the Panama Railroad Company. Of these, about 4,500 are Europeans, mainly Spaniards, with a few Italians and other races. The remainder, about 25,000, are West Indians, about 3,700 of whom are employed as artisans receiving 16, 20, and 25 cents, and a small number, 32 and 44 cents, an hour. The standard rate of the West Indian laborer is 10 cents an hour, but a few of these doing work of an exceptional character are paid 16 and 20 cents. The larger part of the Spaniards are paid 20 cents an hour, and the rest 16 cents an hour.

The material and supply branch carries in eight general storehouses a stock of supplies for the Commission and Panama Railroad valued approximately at $4,500,000. About $12,000,000 worth of supplies are purchased annually, requiring the discharge of one steamer each day.

FOOD, CLOTHING AND OTHER NECESSARIES.

The Canal and Panama Railroad forces are supplied with food, clothing and other necessaries through the Subsistence Department, which is divided into two branches—Commissary and Hotel. It does a business of about seven million five hundred thousand dollars per annum. The business done by the Commissary Department amounts to about $6,000,000 per annum, and that done by the hotel branch to about $1,500,000 per annum.

The Commissary system consists of 22 general stores in as many Canal Zone villages and camps along the relocated line of the Panama Railroad. It is estimated that with employes and their dependents, there are about 65,000 people supplied daily with food, clothing, and other necessaries. In addition to the retail stores, the following plants are operated at Cristobal: cold storage, ice making, bakery, coffee roasting, ice cream, laundry and packing department.

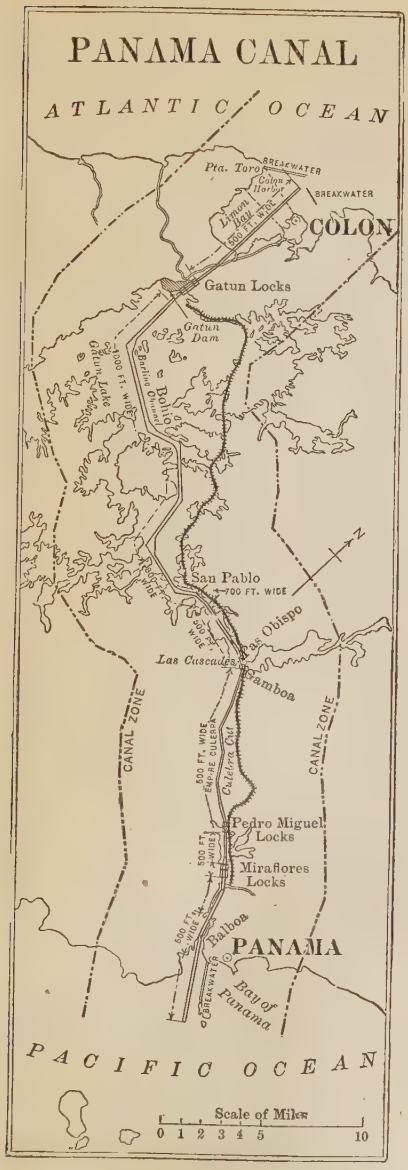
A supply train of 21 cars leaves Cristobal every morning at 4 a. m. It is composed of refrigerator cars containing ice, meats and other perishable articles, and ten containing other supplies. These are delivered at the stations along the line and distributed to the houses of employes by the Quartermaster's Department.

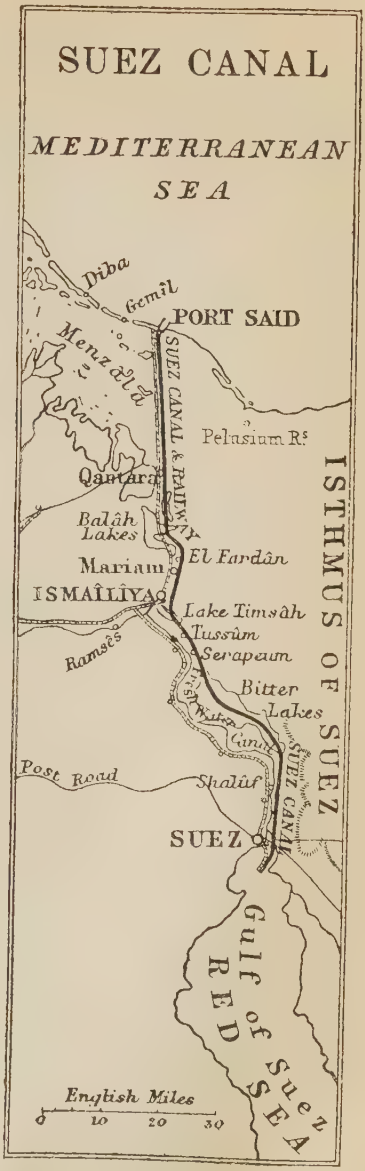
The hotel branch maintains the Hotel Tivoli at Ancon, and also 18 hotels along the line for white gold employes at which meals are served for thirty cents each. At these 18 hotels there are served monthly about 200,000 meals. There are sixteen messes for European laborers, who pay 40 cents per ration of three meals. There are served at these messes about 270,000 meals per month. There are also operated for the West Indian laborers fourteen kitchens, at which they are served a ration of three meals for 27 cents per ration. There are about 100,000 meals served monthly at these kitchens. The supplies for one month for the line hotels, messes and kitchens cost about $85,000; labor and other expenses about $17,500. The monthly receipts, exclusive of the revenue from the Hotel Tivoli, amount to about $105,000.

VALUE OF THE $40,000,000 FRENCH PURCHASE.

A careful official estimate has been made by the Canal Commission of the value to the Commission at the present time of the franchises, equipment, material, work done, and property of various kinds for which the United States paid the French Canal Company $40,000,000. It places the total value at $42,799,826, divided as follows:

Excavation, useful to the Canal, 29,708,000 cubic yards	$25,389,240.00
Panama Railroad Stock	9,644,320.00
Plant and material, used and sold for scrap	2,112,063.00
Buildings, used	2,054,203.00
Surveys, plans, maps and records	2,000,000.00
Land	1,000,000.00
Clearings, roads, etc	100,000.00
Ship channel in Panama Bay, four years' use	500,000.00
Total	$42,799,826.00


PANAMA CANAL
ATLANTIC OCEAN
Pta. Toro
BREAKWATER
Colon Harbor
BREAKWATER
Limon Bay
500 Ft. Wide
COLON
Gatun Locks
Gatun Dam
Gatun Lake
500 FT. WIDE
Bohio Diversion
Bohio
San Pablo
700 FT. WIDE
500 FT. WIDE
Las Obispo
Las Cascades
Gamboa
CANAL ZONE
CANAL ZONE
500 FT. WIDE
Culebra Cut
Pedro Miguel Locks
500 FT. WIDE
Miraflores Locks
500 FT. WIDE
Balboa
PANAMA
BREAKWATER
Bay of Panama
PACIFIC OCEAN
Scale of Miles
0 1 2 3 4 5 10


SUEZ CANAL
MEDITERRANEAN SEA
Diba
Gemil
PORT SAID
Menzala
SUEZ CANAL & RAILWAY
Pelusium R.s
ISTHMUS OF SUEZ
Qantara
Balâh Lakes
El Fardân
Mariam
ISMAÎLÎYAH
Lake Timsâh
Tussûm
Ramsês
Serapeum
Bitter Lakes
Canal
SUEZ CANAL
Post Road
Shalûf
SUEZ
Gulf of Suez
RED SEA
English Miles
0 10 20 30

THE CANAL ZONE.

The Canal Zone contains about 448 square miles. It begins at a point three marine miles from mean low water mark in each ocean, and extends for five miles on each side of the center line of the route of the Canal. It includes the group of islands in the Bay of Panama named Perico, Naos, Culebra, and Flamenco. The cities of Panama and Colon are excluded from the Zone, but the United States has the right to enforce sanitary ordinances in those cities, and to maintain public order in them in case the Republic of Panama should not be able, in the judgment of the United States, to do so.

Of the 448 square miles of Zone territory, the United States owns the larger portion the exact amount of which is being determined by survey. Under the treaty with Panama, the United States has the right to acquire by purchase, or by the exercise of the right of eminent domain, any lands, buildings, water rights, or other properties necessary and convenient for the construction, maintenance, operation, sanitation, and protection of the Canal, and it can, therefore, at any time acquire the lands within the Zone boundaries which are owned by private persons.

RELOCATED PANAMA RAILROAD.

The new, or relocated line of the Panama Railroad is 47.1 miles long, or slightly shorter than the old line. From Colon to Mindi, 4.17 miles, and from Corozal to Panama, 2.83 miles, the old location is used, but the remaining 40 miles are new road. From Mindi to Gatun the railroad runs, in general, parallel to the Canal, and ascends from a few feet above tide water elevation to nearly 95 feet above. At Gatun the road leaves the vicinity of the Canal and runs east along the valley of the Gatun River to a point about 4½ miles from the center line of the Canal, where it turns southward again and skirts the east shore of Gatun Lake to the beginning of Culebra Cut, at Bas Obispo. In this section there are several large fills, occurring where the line crosses the Gatun Valley and near the north end of Culebra Cut, where the line was located so as to furnish waste dumps for the dirt from the Canal. Originally it was intended to carry the railroad through Culebra Cut on a 40-foot berm, 10 feet above the water level, but the numerous slides have made this plan impracticable and a line is now being constructed around the Cut, known locally as the Gold Hill Line. Leaving the berm of the Canal at Bas Obispo, the Gold Hill Line gradually works into the foot hills, reaching a distance from the center line of the Canal of two miles opposite Culebra; thence it runs down the Pedro Miguel Valley to Paraiso, where it is only 800 feet from the center line of the Canal. This section of the line is located on maximum grade of 1.25 per cent. compensated, and has a total length of 9⅜ miles. The sharpest curve on the whole line is 7°. From the south end of Culebra Cut to Paraiaso, the railroad runs practically parallel with the Canal to Panama, with maximum grade of 0.45 per cent. Where the railroad crosses the Gatun River, a bascule steel bridge is to be erected, and a steel girder bridge, ¼ mile long, with 200-foot through truss channel span, is in use across the Chagres River at Gamboa. Small streams are crossed on reinforced concrete culverts. Near Miraflores, a tunnel 736 feet long has been built through a hill. Total cost of new line is estimated at $9,000,000.

THE EQUIPMENT FOR THE CONSTRUCTION OF THE CANAL.

The Equipment consists of the latest and most efficient appliances, the quality of which has been demonstrated by the remarkable totals of excavation which have been recorded during the progress of the work. It includes 100 steam shovels, most of which are of from 70 to 105 tons weight and 3 to 5 cubic yards bucket capacity; 158 American locomotives of from 106 to 117 tons weight; 112 small French locomotives of 20 to 30 tons; 45 narrow gauge and electric locomotives; 560 drills; 4,346 cars; 84 spreaders, track-shifters, unloaders, etc., 20 dredges; 57 cranes; 12 tugs; 70 barges, scows, etc. and 14 launches. The Panama Railroad has 70 locomotives; 57 coaches and 1,477 freight cars.

CANAL STATISTICS.

Length from deep water to deep water (miles)	50
Length from shore-line to shore-line (miles)	40
Bottom width of channel, maximum (feet)	1,000
Bottom width of channel, minimum, 9 miles, Culebra Cut (feet)	300
Locks, in pairs	12
Locks, usable length (feet)	1000
Locks, usable width (feet)	110
Gatun Lake, area (square miles)	164
Gatun Lake, channel depth (feet)	85 to 45
Culebra Cut, channel depth (feet)	45
Excavation, estimated total (cubic yards)	182,537,766
Excavation, amount accomplished May 1, 1911 (cubic yards)	137,750,520
Excavation by the French (cubic yards)	78,146,960
Excavation by French, useful to present Canal, (cubic yards)	29,908,000
Excavation by French, estimated value to Canal	$25,389,240
Value of all French property	$42,799,826
Concrete, total estimated for Canal (cubic yards)	5,000,000
Time of transit through completed Canal (hours)	10 to 12
Time of passage through locks (hours)	3
Relocated Panama Railroad, estimated cost	$9,000,000
Relocated Panama Railroad, length (miles)	47.1
Canal Zone, area (square miles)	448
Canal and Panama Railroad force actually at work (about)	35,000
Canal and Panama Railroad force, Americans (about)	5,000
Cost of Canal, estimated total	$375,000,000
Work begun by Americans	May 4, 1904
Date of completion	Jan. 1, 1915

Approximate cost of various canals: Suez, $19,000,000; Manchester Ship Canal, $15,000,000; Kiel Canal, $8,000,000; Sault Ste. Marie Canal, U. S., $1,200,000; Amsterdam Canal, $2,000,000; Corinth Canal, $1,000,000; Cronstadt Canal, $2,000,000; Welland Canal (Lake Erie to Lake Ontario), $5,000,000.

COALING STATIONS OF NORTH AND SOUTH AMERICA.

DISTANCES FROM NEW YORK, NEW ORLEANS, SAN FRANCISCO, AND PORT TOWNSEND TO THE PRINCIPAL PORTS OF THE WORLD AND THE PRINCIPAL CITIES OF THE UNITED STATES.

[Sources: Water routes in nautical miles, Hydrographic Office, Navy Department; land routes in statute miles, War Department.]

FOREIGN CITIES.[1]

Port and route.	New York.	New Orleans.	San Francisco.	Port Townsend.
Aden:				
Via Suez Canal	6,532	7,870	.....	.....
Via Cape of Good Hope	10,985	11,408	.....	.....
Via Suez Canal and New York	.....	.....	[2] 9,723	[2] 9,731
Via Cape of Good Hope and New York	.....	.....	[2] 14,176	[2] 14,184
Via Suez and Tehuantepec	.....	.....	9,500	10,300
Via Suez and Panama	.....	.....	10,800	11,600
Via Suez and Magellan Strait	.....	.....	15,900	16,700
Via Singapore	[2] 14,499	[2] 14,279	11,500	11,300
Via Singapore and Port Townsend	[2] 14,691	[2] 13,982	.....	.....
Via Singapore and San Francisco	3,325	4,853	.....	.....
Antwerp	.....	.....	[2] 6,516	[2] 6,524
Via New York	.....	.....	7,554	8,329
Via Tehuantepec	.....	.....	8,264	9,039
Via Panama	.....	.....	13,671	14,446
Via Magellan Strait	.....	.....	7,800	7,600
Batavia (Java)	12,323	11,075	.....	.....
Via Tehuantepec	13,167	12,566	.....	.....
Via Panama	10,182	11,598	.....	.....
Via Suez Canal	11,855	12,278	.....	.....
Via Cape of Good Hope	.....	.....	.....	.....
Bombay:				
Via Suez Canal	8,120	9,536	.....	.....
Via Cape of Good Hope	11,250	11,848	.....	.....
Via Suez and New York	.....	.....	[2] 11,311	[2] 11,319
Via Cape of Good Hope and New York	.....	.....	[2] 14,441	[2] 14,449
Via Suez and Tehuantepec	.....	.....	12,110	12,885
Via Suez and Panama	.....	.....	12,512	13,287
Via Cape of Good Hope and Tehuantepec	.....	.....	15,108	15,800
Via Cape of Good Hope and Panama	.....	.....	14,500	15,270
Via Magellan Strait	.....	.....	15,064	15,839
Via Singapore	[2] 12,771	[2] 12,559	9,780	9,580
Via Singapore and Port Townsend	[2] 12,971	[2] 12,262	.....	.....
Via Singapore and San Francisco	13,993	12,745	.....	.....
Via Singapore and Tehuantepec	14,837	14,236	.....	.....
Via Singapore and Panama	.....	.....	.....	.....
Hamburg	3,652	5,243	.....	.....
Via New York	1,227	597	[2] 6,843	[2] 6,851
Habana	.....	.....	[2] 3,079	[2] 4,006
Via New Orleans	.....	.....	3,219	3,992
Via Tehuantepec	.....	.....	4,337	5,112
Via Panama	3,169	4,760	.....	.....
Havre	.....	.....	[2] 6,360	[2] 6,368
Via New York	.....	.....	6,086	5,886
Hongkong	[2] 9,085	[2] 8,865	.....	.....
Via Port Townsend	[2] 9,277	[2] 8,568	.....	.....
Via San Francisco	10,572	9,317	.....	.....
Via Tehuantepec	11,431	10,830	.....	.....
Via Panama	11,610	12,892	.....	.....
Via Suez	13,590	13,863	.....	.....
Via Cape of Good Hope	16,868	17,318	.....	.....
Via Magellan Strait	.....	.....	2,097	2,370
Honolulu	[2] 5,288	[2] 4,579	.....	.....
Via San Francisco	[2] 5,569	[2] 5,349	.....	.....
Via Port Townsend	6,686	6,085	.....	.....
Via Panama	5,806	4,582	.....	.....
Via Tehuantepec	13,269	13,719	.....	.....
Via Magellan Strait	1,473	1,165	.....	.....
Kingston, Jamaica	5,662	6,580	.....	.....
Kongo River, mouth of	.....	.....	[2] 9,062	[2] 9,559
Via New Orleans	.....	.....	[2] 8,853	[2] 8,859
Via New York	3,053	4,553	.....	.....
Liverpool	.....	.....	[2] 6,244	[2] 6,250
ViaNew York	.....	.....	7,769	7,944
Via Tehuantepec	.....	.....	8,038	8,813
Via Panama	.....	.....	13,503	14,278
Via Magellan Strait	3,233	4,507	.....	.....
London	.....	.....	[2] 6,424	[2] 6,432
Via New York	.....	.....	7,349	8,124
Via Tehuantepec	.....	.....	8,218	8,993
Via Panama	.....	.....	13,683	14,458
Via Magellan Strait	.....	.....	.....	.....

Brest, France	2,954	4,458		
Via New York			[2] 6,145	[2] 6,154
Via Tehuantepec			7,154	7,029
Via Panama			7,840	8,619
Via Magellan Strait			13,209	13,984
Buenos Aires	5,868	6,318		
Via Magellan Strait			7,511	8,286
Via New York			[2] 9,059	[2] 9,067
Bermuda	676	1,648		
Via New York			[2] 3,867	[2] 3,875
Calcutta:				
Via Suez	9,830	11,289		
Via Cape of Good Hope	12,180	12,838		
Via Suez and New York			[2] 13,021	[2] 13,029
Via Cape of Good Hope and New York			[2] 15,371	[2] 15,379
Via Singapore			8,990	8,896
Via Singapore and San Francisco	[2] 12,181	[2] 11,462		
Via Singapore and Tehuantepec	13,405	12,181		
Via Singapore and Panama	14,230	13,694		
Callao:				
Via Tehuantepec	4,246	2,991		
Via Panama	3,392	2,764		
Via Magellan Strait	9,603	10,142		
Direct			4,012	4,769
Cape Town:				
Direct	6,815	7,374		
Via New York			[2] 10,006	[2] 10,014
Via Tehuantepec			9,700	10,475
Via Panama			9,898	10,676
Via Magellan Strait			10,454	11,229
Colon (eastern end of Panama Canal) [3]	1,981	1,380		
Via Canal and Panama			3,324	4,090
Colombo:				
Via Suez Canal	8,610	10,146		
Via Cape of Good Hope	11,130	11,684		
Via Suez and New York			[2] 11,801	[2] 11,809
Via Cape of Good Hope and New York			[2] 14,321	[2] 14,329
Via Singapore			8,900	8,700
Copenhagen:				
Direct	5,852	5,443		
Via New York			[2] 7,043	[2] 7,051
Gibraltar	3,207	4,576		
Via New York			[2] 6,398	[2] 6,406
Via Tehuantepec			7,240	8,015
Via Panama			7,642	8,417
Via Magellan Strait			12,734	13,509
Guam			5,054	4,908
Via San Francisco	[2] 8,245	[2] 7,536		
Via Port Townsend	[2] 8,107	[2] 7,887		
Manila:				
Via Honolulu and San Bernardino Strait			6,943	7,213
Via Yokohama			6,289	5,993
Via Yokohama and San Francisco	[2] 9,480	[2] 8,771		
Via Yokohama and Port Townsend	[2] 9,192	[2] 8,972		
Via Tehuantepec	10,735	9,480		
Via Panama	11,546	10,993		
Via Suez	11,556	12,946		
Via Cape of Good Hope	13,536	13,986		
Via Suez and New York			[2] 14,747	[2] 14,755
Via Cape of Good Hope and New York			[2] 16,727	[2] 16,735
Via Magellan Strait	16,736	17,145		
Marseille	3,876	5,266		
Via New York			[2] 7,067	[2] 7,073
Via Tehuantepec			7,930	8,705
Via Panama			8,332	9,107
Via Magellan Strait			13,324	14,099
Melbourne			7,040	7,311
Via San Francisco	[2] 10,231	[2] 9,522		
Via Panama	10,028	9,427		
Via Tehuantepec	9,852	8,604		
Via Magellan Strait	12,880	13,143		
Via Suez Canal	12,981	14,303		
Via Cape of Good Hope	12,670	12,933		
Mexico City	[2] 2,399	[2] 1,172	[2] 2,142	[2] 2,917
	[4] 2,898	[4] 1,526	[4] 2,512	[4] 3,349
Naples	4,172	5,562		
Via New York			[2] 7,363	[2] 7,369
New Orleans	1,741 / [4] 1,372		[4] 2,482	[4] 2,979
Via Tehuantepec			3,191	3,966
Via Panama			4,704	5,479
New York	1,741 / [4] 1,372		[4] 3,191	[4] 3,199
Via Tehuantepec			4,415	5,190
Via Panama			5,305	6,080
Nome, Alaska			2,705	2,356
Via San Francisco	[2] 5,896	[2] 5,187		
Via Port Townsend	[2] 5,555	[2] 5,335		
Via Tehuantepec	7,130	5,902		
Via Panama	8,010	7,410		
Via Magellan Strait	15,840	16,249		
Odessa, via Gibraltar	5,370	6,760		
Panama (western end of Panama Canal) [3]			3,277	4,052
Via canal and Colon	2,028	1,427		
Pernambuco, Brazil	3,696	3,969		
Via New York			[2] 6,887	[2] 6,895
Via New Orleans			[2] 6,451	[2] 6,948
Via Tehuantepec			6,591	7,366

[1] Distances given are by water except as otherwise stated. [2] By land and water. [3] Distance by canal from Colon to Panama, 47 miles. [4] By land.

DISTANCES FROM NEW YORK, NEW ORLEANS, SAN FRANCISCO, AND PORT TOWNSEND TO THE PRINCIPAL PORTS OF THE WORLD AND THE PRINCIPAL CITIES OF THE UNITED STATES—Continued.

FOREIGN CITIES—Continued.

Port and route.	New York.	New Orleans.	San Francisco.	Port Townsend.
Pernambuco, Brazil—Continued.				
Via Panama			6,530	7,305
Via Magellan Strait			9,439	10,214
Port Said, Egypt	5,122	6,509		
Via New York			[1] 8,321	[1] 8,327
Via Tehuantepec			9,160	9,935
Via Panama			9,562	10,337
Port Townsend	[2] 3,199	[2] 2,979	775	
Via Tehuantepec	5,190	3,966		
Via Panama	6,080	5,479		
Punta Arenas (Magellan Strait)	6,890	7,340	6,199	6,958
Rio de Janeiro	4,778	5,218		
Via New York			[1] 7,969	[1] 7,977
Via New Orleans			[1] 7,700	[1] 8,197
Via Tehuantepec			7,730	8,505
Via Panama			7,678	8,453
Via Magellan Strait			8,339	9,114
San Francisco	[2] 3,191	[2] 2,482		775
Via Tehuantepec	4,415	3,191		
Via Panama	5,305	4,704		
St. Petersburg:				
Direct	4,632	6,223		
Via New York			[1] 7,823	[1] 7,829
San Juan, P. R.	1,428	1,539		
Via New York			[1] 4,619	[1] 4,627
Via New Orleans			[1] 4,021	[1] 4,518
Via Tehuantepec			4,182	4,957
Via Panama			4,345	5,120
Via Magellan Strait			12,199	12,974
Singapore			7,502	7,206
Via San Francisco	[1] 10,693	[1] 9,984		
Via Port Townsend	[1] 10,405	[1] 10,185		
Via Suez	10,170	11,560		
Via Cape of Good Hope	12,355	12,914		
Via Yokohama and Panama	13,104	12,503		
Via Yokohama and Tehuantepec	12,209	10,961		

Port and route.	New York.	New Orleans.	San Francisco.	Port Townsend.
Shanghai			5,550	5,290
Via San Francisco	[1] 8,741	[1] 8,032		
Via Port Townsend	[1] 8,489	[1] 8,269		
Via Tehuantepec	9,965	8,741		
Via Panama	10,855	10,254		
Via Suez	12,360	13,750		
Via Cape of Good Hope	14,593	14,806		
Tehuantepec:				
Western end of railroad [3]			2,189	2,964
Eastern end of railroad [3]	2,036	812		
Tutuila			4,150	4,607
Via San Francisco	[1] 7,341	[1] 6,632		
Valparaiso			5,140	5,902
Via San Francisco	8,331	7,622		
Via Tehuantepec	5,480	4,256		
Via Panama	4,037	4,035		
Via Magellan Strait	8,460	8,733		
Vladivostok			4,706	4,357
Via San Francisco	[1] 7,897	[1] 7,188		
Via Port Townsend	[1] 7,556	[1] 7,336		
Via San Francisco and Tehuantepec	9,122	8,874		
Via San Francisco and Panama	10,061	9,410		
Via Magellan Strait	17,036	17,445		
Wellington, New Zealand			5,909	6,415
Via San Francisco	[1] 9,100	[1] 8,391		
Via Tehuantepec	8,344	7,096		
Via Panama	8,540	7,939		
Via Magellan Strait	11,500	11,773		
Via Suez	14,230	15,620		
Via Cape of Good Hope	13,710	14,058		
Yokohama			4,536	4,240
Via Honolulu			5,500	5,770
Via San Francisco	[1] 7,727	[1] 7,018		
Via Port Townsend	[1] 7,439	[1] 7,219		
Via Honolulu and Tehuantepec	9,243	7,995		
Via San Francisco and Tehuantepec	8,986	7,762		

DISTANCES FROM ATLANTIC TO PACIFIC PORTS BY THE PRESENT ROUTES.

(In Nautical Miles.)

(Prepared expressly for The American Almanac by Captain W. H. H. Sutherland, Hydrographer, U. S. Navy.)

From.	To Port Townsend, via San Francisco.	To San Francisco.	To Guayaquil.	To Callao.	To Iquique.	To Valparaiso.	To Coronel.	To Yokohama, via San Francisco.	To Shanghai, via San Francisco and Yokohama.	To Manila, via San Francisco and Yokohama.	To Sydney, via Tahiti.	To Melbourne, via Tahiti and Sydney.	To Wellington, via Tahiti.
New York	14,019	13,244	10,423	9,702	9,221	8,461	7,860	17,780	18,910	19,530	14,560	15,135	13,600
Norfolk	13,945	13,170	10,349	9,628	9,147	8,387	7,786	17,706	18,836	19,456	14,486	15,061	13,526
Charleston	13,954	13,179	10,358	9,637	9,156	8,396	7,795	17,715	18,845	19,465	14,495	15,070	13,535
Port Tampa	14,119	13,344	10,523	9,802	9,321	8,561	7,960	17,880	19,010	19,630	14,660	15,235	13,700
New Orleans	14,419	13,644	10,823	10,102	9,621	8,861	8,260	18,180	19,310	19,930	14,960	15,535	14,000
Galveston	14,601	13,826	11,005	10,284	9,803	9,043	8,442	18,362	19,492	20,112	15,142	15,717	14,182
Liverpool	14,619	13,844	11,023	10,302	9,821	9,061	8,460	18,380	19,510	20,130	15,160	15,735	14,200
Hamburg	15,019	14,244	11,423	10,702	10,221	9,461	8,860	18,780	19,910	20,530	15,560	16,135	14,600
Antwerp	14,754	13,979	11,158	10,437	9,956	9,196	8,595	18,515	19,645	20,265	15,295	15,870	14,335
Bordeaux	14,474	13,691	10,868	10,157	9,676	8,916	8,315	18,235	19,365	19,985	15,015	15,590	14,055
Gibraltar	13,518	12,743	9,922	9,211	8,720	7,960	7,359	17,009	18,409	19,030	14,059	14,634	13,099

DISTANCES FROM ATLANTIC PORTS TO PACIFIC PORTS, VIA THE PANAMA CANAL, WHEN CONSTRUCTED.

(From a special report by the United States Treasury Department.)

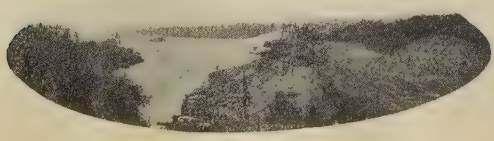
From.	To Port Townsend, via San Francisco.	To San Francisco.	To Guayaquil.	To Callao.	To Iquique.	To Valparaiso.	To Coronel.	To Yokohama, via San Francisco.*	To Shanghai, via San Francisco and Yokohama.*	To Manila, via San Francisco and Yokohama.*	To Sydney, via Tahiti.†	To Melbourne, via Tahiti and Sydney.†	To Wellington, via Tahiti.§
New York	6,074	5,299	2,864	3,359	4,021	4,630	4,838	9,835	10,885	11,585	9,852	10,427	8,892
Norfolk	5,872	5,097	2,662	3,157	3,819	4,428	4,636	9,634	10,684	11,384	9,650	9,858	8,690
Charleston	5,673	4,898	2,463	2,958	3,638	4,229	4,437	9,544	10,307	10,809	9,451	10,006	8,491
Port Tampa	5,328	4,553	2,098	2,593	3,255	3,864	4,072	9,069	10,119	10,819	9,086	9,661	8,126
New Orleans	5,477	4,698	2,263	2,758	3,420	4,029	4,237	9,234	10,284	10,984	9,251	9,826	8,291
Galveston	5,574	4,799	2,364	2,858	3,520	4,129	4,338	9,335	10,385	11,085	9,352	9,927	8,392
Liverpool	8,813	8,038	5,603	6,098	6,760	7,369	7,577	12,574	13,624	14,324	12,591	13,166	11,631
Hamburg	9,242	8,467	6,032	6,527	7,189	7,798	8,006	13,003	14,053	14,753	13,020	13,595	12,060
Antwerp	8,963	8,188	5,753	6,248	6,910	7,519	7,727	12,724	13,774	14,474	12,741	13,316	11,781
Bordeaux	8,713	7,938	5,503	5,998	6,660	7,269	7,477	12,474	13,524	14,224	12,491	13,066	11,471
Gibraltar	8,447	7,672	5,237	5,723	6,394	7,003	7,211	12,208	13,258	13,958	12,221	11,168	11,265

* Via Honolulu, add 252 miles.

† Omitting Tahiti reduces voyage from Brito by 52 miles.

‡ Voyage from Brito to Sydney by way of Wellington is 232 miles less than by way of Tahiti; from Panama it is 405 miles less.

§ Voyage from Brito to Wellington direct is 185 miles shorter than via Tahiti, and from Panama it is 358 miles shorter.



VIEW AT ATLANTIC ENTRANCE.

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THE NEW MUNICIPAL BUILDING OF THE CITY OF NEW YORK.

This building will house many departments of the city government and will save hundreds of thousands of dollars annually in rent.

CHAPTER IX.

TELEGRAPHS AND CABLES.

THE PREPARATION OF DOMESTIC TELEGRAPH MESSAGES.

A message to be transmitted by telegraph should be written upon the blank provided by the Telegraph Company for that purpose; or it should be attached to such blank by the sender, or by the one presenting the message as the sender's agent, so as to leave the printed heading in full view above the written message.

Write the whole message, date, address, body and signature as clearly as possible. Avoid changes, corrections and unusual abbreviations. Figures, counted and charged for at the rate of one word for each, may be used, but words to represent them are less liable to cause error.

Addresses are not charged for, therefore they should be full and clear and written so as to be easily understood. If the person addressed is known to be at a considerable distance from the office, or in some locality where the services of a special messenger may be required to reach him, this fact should be made known to the Telegraph Company. By such notice a quicker delivery of the message may be often effected.

If the sender's address is not known to the Telegraph Company, it should be written on the back or at the bottom of the blank. This will enable the Telegraph Company to reach him either with a reply, should one be received or for any possible question which might arise in reference to the transmission or delivery of his message.

Rules for counting messages, which will completely cover all the usual and unusual words, abbreviations and combinations used in telegraph messages, cannot be given here. A charge is made for the first ten words or less, and a reduced rate for each word over ten. The address and signature are not charged for.

In counting a message "dictionary" words (*i. e.*, words taken from one of the following languages, namely, English, German, French, Italian, Dutch, Portuguese, Spanish and Latin), initial letters, surnames of persons, names of cities, towns, villages, states or territories, or names of the Canadian provinces, will be counted and charged for each as one word. The abbreviations for the names of towns, villages, states, territories and provinces will be counted and charged for the same as if written in full. Abbreviations of weights and measures in common use will be counted each as one word.

Examples:

Signatory (English)	1 word
Auf wiedersehen (*German*)	2 words
A bon marché (*French*)	3 "
Erba mala presto cresce (*Italian*)	4 "
El corazón menda las carnes (*Spanish*)	5words
Errare humanum est (*Latin*)	3 "
J G M Jones, Jr.	5 "
Van Dorne	1 "
McGregor	1 "
O'Connor	1 "
District of Columbia (or D. C.)	1 "
New York (or N. Y.)	1 "
New York State	2 "
St. Louis	1 "
East St. Louis	1 "
New Mexico (or N. M.)	1 "
Nova Scotia (or N. S.)	1 "
Lbs.	1 "
Hhds.	1 "
Cwt.	1 "

In names of countries or counties all the words will be counted and charged for.

Examples:

United States of Colombia	4 words
U. S. A.	3 "
North America	2 "
Queen Anne County	3 "

All groups of letters, when such groups do not form dictionary words, and are not combinations of dictionary words, will be counted at the rate of five letters or fraction of five letters to a word. When such groups are made up of combinations of dictionary words, each dictionary word so used will be counted.

Examples:

Ukugu (*artificial*)	1 word
Babelu (*artificial*)	2 "
Bacyzafyih (*artificial*)	2 "
Abycazfybgk (*artificial*)	3 "
Hhgga (*artificial*)	1 "
Doyou (*improperly combined*)	2 "
Canhe (*improperly combined*)	2 "
Allright (or alright) (*improperly combined*)	2 "
Housemate (*dictionary word*)	1 "

Figures, decimal points and bars of division will be counted, each separately, as one word. In groups consisting of letters and figures, each letter and figure will be counted as one word.

Examples:

A1	2 words
x9n8g	5 "
¾	3 "
74 ¾	5 "
4442	4 "
44, 42	5 "
165 East 22d St.	8 "

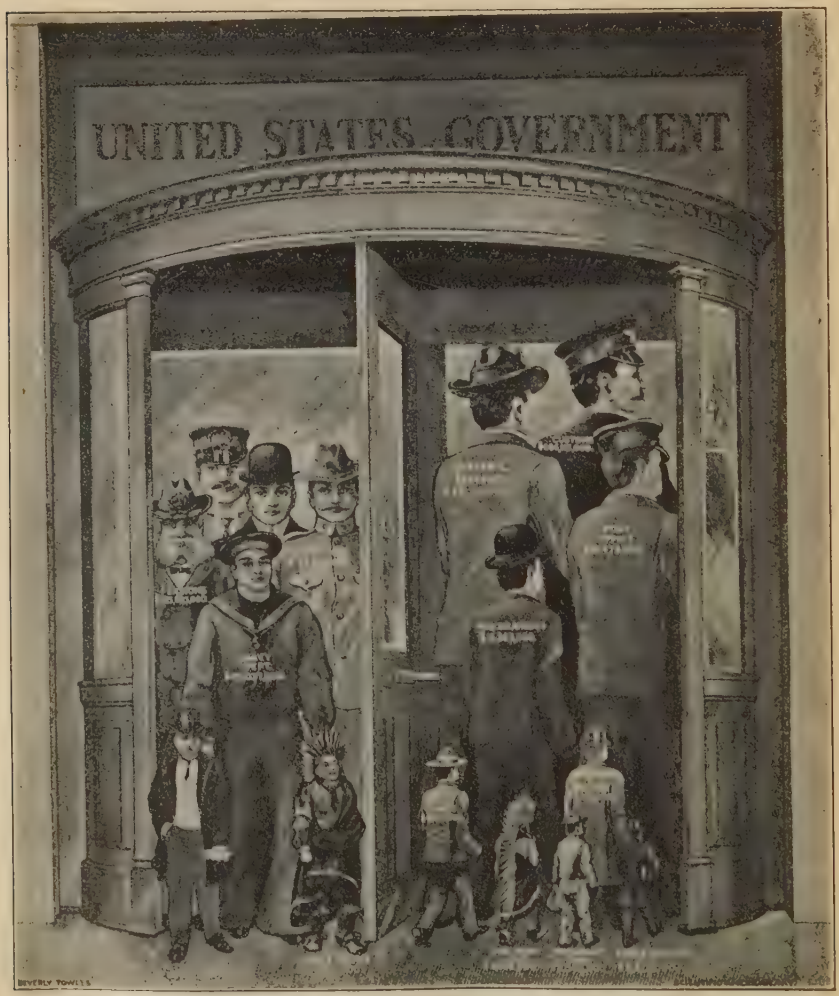
Exceptions:

A. M.	1 word
P. M.	1 "
F. O. B. (or fob)	1 "
C. O. D. (or cod)	1 "
C. I. F. or C. F. I. (or cif or cfi)	1 "
C. A. F. (or caf)	1 "
O. K.	1 "
Per cent (or percent)	1 "

In ordinal numbers the affixes st, nd, rd and th will each be counted as one word.

Examples:

1st	2 words
2nd	2 "
3rd	2 "
4th	2 "



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RECEIPTS AND EXPENDITURES OF THE UNITED STATES GOVERNMENT FOR THE FISCAL YEAR ENDING JUNE 30, 1908.

While the amounts shown are usually increasing annually, the relation they bear to each other is practically constant and hence the drawing is useful as a means of comparison.

LAND LINES OF THE WORLD.

Below are given such particulars as we have been able to obtain of the land line telegraphs throughout the world, corrected up to December, 1911:—

Countries.	Length of Lines in Miles.			Length of Conductors in Miles.			Pneumatic Tubes. (Yards)
	Aerial.	Underground.	Total.	Aerial.	Underground.	Total.	
African Transcontinental Tel. Co.	1,584	.....	1,584	.....	.....	.....	.....
America (United States of)—	1,595	.....	1,595	1,595	.....	1,595	.....
Commercial Cable Co.	27,921	173	28,094	202,850	10,001	212,851	11,066
[1]Western Union Tel. Co.	205,136	405	205,541	1,423,159	33,600	1,456,759	.....
Argentine Republic	13,596	20	13,616	32,779	80	32,859	.....
Austria	28,362	170	28,532	141,268	4,161	145,429	94,292
[3]Bahamas	6	.....	6	.....	.....	.....	.....
Barbados	1,250	.....	1,250	.....	.....	.....	.....
Belgium	4,543	14	4,557	23,198	856	24,054	3,352
Bolivia	1,795	.....	1,795	.....	.....	.....	.....
Brazil	19,654	14	19,668	35,574	94	35,668	23,731
British East Africa	120	.....	120	126	.....	126	.....
British Guiana (including Cable Co.'s lines)	974	.....	974	974	.....	974	.....
British India	72,553	193	72,746	284,067	3,199	287,266	.....
British North Borneo	800	.....	800	800	.....	800	.....
Bulgaria	3,676	2	3,678	7,842	70	7,912	.....
Canada—Gt. N.-W. Tel. Co.	18,286	.....	18,286	35,721	.....	35,721	.....
Canadian Pacific Telegraphs	12,255	2	12,257	75,872	886	76,758	.....
Government Tel. Service	6,929	.....	6,929	6,929	.....	6,929	.....
Western Union Tel. Co.	2,707	11	2,718	13,979	44	14,023	.....
Ceylon	1,790	2	1,792	4,558	37	4,595	.....
Chili	7,473	.....	7,473	13,408	.....	13,408	.....
China	25,308	6	25,314	41,805	102	41,907	.....
Colombia	620	.....	620	.....	.....	.....	.....
Costa Rica	835	.....	835	.....	.....	.....	.....
Cuba	7,119	.....	7,119	7,119	.....	7,119	.....
[4]Denmark	3,242	64	3,306	11,725	363	12,088	.....
Dominican Republic	1,444	.....	1,444	1,444	.....	1,444	.....
East African Protectorate	1,016	.....	1,016	2,261	.....	2,261	.....
Ecuador	3,754	4	3,758	.....	.....	.....	.....
Egypt	3,666	.....	3,666	12,743	.....	12,743	.....
France and Corsica	86,214	4,315	90,529	329,525	25,517	355,042	354,987
French Guiana (Cayenne)	195	.....	195	195	.....	195	.....
French Indo-China (Cochin-China, Cambodgia, Annam, Tonkin and Laos)	8,417	8	8,425	14,231	108	14,339	.....
French Guinea	1,430	.....	1,430	1,430	.....	1,430	.....
French Ivory Coast	1,584	.....	1,584	1,584	.....	1,584	.....
French Dahomey	1,143	.....	1,143	1,143	.....	1,143	.....
French Congo and Dependencies	1,600	.....	1,600	1,600	.....	1,600	.....
[5]Germany	137,154	4,041	141,195	388,420	29,601	418,021	278,878
Carried forward	717,746	9,444	727,190	3,119,924	108,719	3,228,643	766,306

[1]Inclusive of 388 miles of submarine cables, with 45 conductors.
[3]There are 971 miles of telephone lines.
[4]Exclusive of 206 miles of river cables and 526 miles of conductors.
[5]Including inter-urban telephone lines and also of 4,602 miles of land lines (16,233 miles of conductors) owned by Government Railways.—*From Electrical Trades Directory.*

Countries.	Length of Lines in Miles.			Length of Conductors in Miles.			Pneumatic Tubes. (Yards)
	Aerial.	Underground.	Total.	Aerial.	Underground.	Total.	
Brought forward	717,746	9,444	727,190	3,119,924	108,719	3,228,643	766,306
[8]Great Britain & Ireland	51,972[7]	5,668[9]	57,640	telegraph 182,014 teleph'ne 249,356	156,655 644,721	1,232,746	172,480
Greece	5,029	.....	5,029	.....	.....	.....	.....
[6]Holland	6,230	300	6,530	62,692	1,339	64,031	.....
Hungary	15,470	72	15,542	87,180	2,177	89,357	.....
Indo-European Persian Gulf System (Mekran Coast)	1,121	.....	1,121	2,194	.....	2,194	.....
Indo-European Teheran, Bushire and Central Lines	1,605	.....	1,605	4,799	.....	4,799	.....
Italy	31,994	37	32,031	193,208	1,335	194,543	.....
Jamaica	992	.....	992	.....	.....	.....	.....
[1]Japan	23,008	27	23,035	110,159	1,723	111,882	2,507
Luxemburg	455	.....	455	715	.....	715	.....
Madagascar	2,380	.....	2,380	2,380	.....	2,380	.....
Malay States (Federated)	1,632	5½	1,637½	5,135	.....	5,135	.....
Mauritius	185	.....	185	494	.....	494	.....
Mexico	22,385	3	22,388	48,602	.....	48,602	.....
Netherlands India	6,114	155	6,269	10,635	182	10,817	.....
New Caledonia	632	.....	632	966	.....	966	.....
New South Wales	17,387	204	17,591	99,606	19,427	119,033	1,485
New Zealand	12,708	8	12,716	[5]70,652	4,139	74,791	.....
[2]Nicaragua	[3]3,471	.....	[3]3,471	.....	.....	.....	.....
Norway	11,600	80	11,680	58,750	37,000	95,750	44
Peru	8,666	.....	8,666	10,092	.....	10,092	.....
Portugal	5,708	.....	5,708	12,564	.....	12,564	.....
Portuguese Colonies	2,055	.....	2,055	2,155	.....	2,155	.....
Queensland	10,494	79	10,573	22,799	174	22,973	.....
Roumania	4,517	16	4,533	11,707	196	11,903	.....
Russia	106,656	158	106,814	378,980	1,026	380,006	.....
Senegal: Sénégal	1,357	4	1,361	1,897	4	1,901	.....
H. L. Sénégal Niger	3,337	.....	3,337	4,023	.....	4,023	.....
Servia	2,694	3	2,697	5,064	76	5,140	.....
South Australia	6,224	24	6,248	24,905	4,550	29,455	.....
Spain	16,781	43	16,824	42,457	143	42,600	.....
Straits Settlements	[3]1,292	.....	1,292	1,292	.....	1,292	.....
Sudan	4,998	.....	4,998	9,422	.....	9,422	.....
Sweden	5,976	41	6,017	19,397	768	20,165	.....
Switzerland	4,242	262	[4]4,504	13,413	2,588	16,001	.....
Tasmania	2,095	7	2,102	4,001	7	4,008	.....
Tunis	2,077	5	2,082	5,905	60	5,965	.....
Turkey	27,560	.....	27,560	46,876	.....	46,876	.....
Uganda Protectorate	828	.....	828	972	.....	972	.....
Union of South Africa	17,216	11	17,227	62,531	546	63,077	683
Uruguay	4,898	.....	4,898	4,898	.....	4,898	.....
Victoria—Postal Department	4,049	7	4,056	11,057	492	11,549	3,967
Victoria—Rail'y Department	3,031	.....	3,031	4,740	.....	4,740	.....
West'n Australia Postal Dept	6,905	.....	6,905	11,319	.....	11,319	.....
West'n Australia Rail'y Dept	6,003	.....	6,003	6,284	.....	6,284	.....
Total	1,193,775	16,663½	1,210,438½	5,028,211	988,047	6,016,258	947,472

[1]Exclusive of 23 611 nautical miles of river cables and 45.321 miles of conductors.
[2]Exclusive of 1½ miles of submarine cable. [3]Including telephone lines.
[4]Inclusive of 195 nautical miles of river cables and 478 miles of conductors.
[7]No distinction can be made between telegraph and telephone line mileages.
[8]These figures are for September 30, 1911. [9]Miles of Single Pipe.

TELEGRAPH RATES—NORTH AMERICA

BETWEEN NEW YORK CITY AND PLACES IN UNITED STATES AND CANADA.

Day rate 40–3, means 40 cents for ten words and 3 cents for each additional word; Night rate 30–2, means 30 cents for ten words and 2 cents for each additional word, etc. Address and signature are free. Western Union and Postal Rates are uniform.

Places.	Rate. Day.	Night.
Alabama	60–4	50–3
Alaska:		
Eagle City	3.80–35	3.80–35
Juneau	2.60–23	2.60–23
Nome	4.80–45	4.80–45
St. Michael	4.30–40	4.30–40
Sitka	2.40–21	2.40–21
Skagway	2.90–26	2.90–26
Valdez	3.40–31	3.40–31
Arizona	1.00–7	1.00–7
Arkansas	60–4	50–3
British Columbia: Grand Forks, Nelson, New Westminster, Rossland, Vancouver, Victoria	1.00–7	1.00–7
Atlin	3.25–24	3.25–24
Port Simpson	2.75–19	2.75–19
California	1.00–7	1.00–7
Colorado	75–5	60–4
Connecticut	25–2	25–1
Delaware	30–2	25–1
District of Columbia:		
Washington	30–2	25–1
All other places	40–3	30–2
Florida	60–4	50–3
Georgia	60–4	50–3
Idaho	1.00–7	1.00–7
Illinois	50–3	40–3
Indiana	50–3	40–3
Iowa	60–4	50–3
Kansas	60–4	50–3
Kentucky	50–3	40–3
Louisiana	60–4	50–3
Maine: Portland	35–2	25–1
All other places	40–3	30–2
Manitoba: Winnipeg	75–5	60–4
Maryland: Annapolis, Baltimore, Frederick, Hagerstown	30–2	25–1
Cumberland	35–2	25–1
All other places	30–2 to 40–3	25–1 to 30–2
Massachusetts	25–2 to 30–2	25–1
Michigan: Detroit, Mount Clemens, Port Huron	40–3	30–2
All other places	50–3 to 60–4	40–3 to 50–3
Minnesota	60–4	50–3
Mississippi	60–4	50–3

Places	Rate. Day.	Night.
Missouri:		
St. Louis	50–3	40–3
All other places	60–4	50–3
Montana	75–5	60–4
Nebraska	60–4	50–3
Nevada	1.00–7	1.00–7
New Brunswick	50–3	40–3
Newfoundland: St. John's	1.10–9	1.00–9
New Hampshire	30–2 to 35–2	25–1
New Jersey	25–2	25–1
New Mexico	75–5	60–4
New York:		
New York City	20–1	20–1
All other places	25–2 to 35–2	25–1
North Carolina	50–3	40–3
North Dakota	75–5	60–4
Nova Scotia	50–3	40–3
Ohio	40–3	30–2
Oklahoma	75–5	60–4
Ontario:		
Niagara Falls	40–3	30–2
Sault Ste. Marie	60–4	50–3
All other places	50–3 to 1.00–7	40–3 to 75–5
Oregon	1.00–7	1.00–7
Pennsylvania	25–2 to 40–3	25–1 to 30–2
Prince Edward Island: Charlottetown	75–5	65–5
Quebec	50–3	40–3
Rhode Island	30–2	25–1
South Carolina	60–4	50–3
South Dakota	75–5	60–4
Tennessee	50–3	40–3
Texas	75–5	60–4
Utah	75–5	60–4
Vermont	30–2 to 35–2	25–1
Virginia	40–3 to 50–3	30–2 to 40–3
Washington	1.00–7	1.00–7
West Virginia	40–3	30–2
Wisconsin: Milwaukee	50–3	40–3
All other places	60–4	50–3
Wyoming	75–5	60–4
Yukon:		
Dawson City	4.25–29	4.25–29

NIGHT LETTERS AND DAY LETTERS.

Table of Tolls for 1 to 200 Words.

Words	When Day Message Rate is 25 and 2		When Day Message Rate is 30 and 2		When Day Message Rate is 35 and 2		When Day Message Rate is 40 and 3	
	Night Letter Rate is	Day Letter Rate is	Night Letter Rate is	Day Letter Rate is	Night Letter Rate is	Day Letter Rate is	Night Letter Rate is	Day Letter Rate is
1 to 50	$0.25	$0.38	$0.30	$0.45	$0.35	$0.53	$0.40	$0.60
51 " 60	.30	.45	.36	.54	.42	.63	.48	.72
61 " 70	.35	.53	.42	.63	.49	.74	.56	.84
71 " 80	.40	.60	.48	.72	.56	.84	.64	.96
81 " 90	.45	.68	.54	.81	.63	.95	.72	1.08
91 " 100	.50	.75	.60	.90	.70	1.05	.80	1.20
101 " 110	.55	.83	.66	.99	.77	1.16	.88	1.32
111 " 120	.60	.90	.72	1.08	.84	1.26	.96	1.44
121 " 130	.65	.98	.78	1.17	.91	1.37	1.04	1.56
131 " 140	.70	1.05	.84	1.26	.98	1.47	1.12	1.68
141 " 150	.75	1.13	.90	1.35	1.05	1.58	1.20	1.80
151 " 160	.80	1.20	.96	1.44	1.12	1.68	1.28	1.92
161 " 170	.85	1.28	1.02	1.53	1.19	1.79	1.36	2.04
171 " 180	.90	1.35	1.08	1.62	1.26	1.89	1.44	2.16
181 " 190	.95	1.43	1.14	1.71	1.33	2.00	1.52	2.28
191 " 200	1.00	1.50	1.20	1.80	1.40	2.10	1.60	2.40

Words	When Day Message Rate is 50 and 3		When Day Message Rate is 60 and 4		When Day Message Rate is 75 and 5		When Day Message Rate is 100 and 7	
	Night Letter Rate is	Day Letter Rate is	Night Letter Rate is	Day Letter Rate is	Night Letter Rate is	Day Letter Rate is	Night Letter Rate is	Day Letter Rate is
1 to 50	$0.50	$0.75	$0.60	$0.90	$0.75	$1.13	$1.00	$1.50
51 " 60	.60	.90	.72	1.08	.90	1.35	1.20	1.80
61 " 70	.70	1.05	.84	1.26	1.05	1.58	1.40	2.10
71 " 80	.80	1.20	.96	1.44	1.20	1.80	1.60	2.40
81 " 90	.90	1.35	1.08	1.62	1.35	2.03	1.80	2.70
91 " 100	1.00	1.50	1.20	1.80	1.50	2.25	2.00	3.00
101 " 110	1.10	1.65	1.32	1.98	1.65	2.48	2.20	3.30
111 " 120	1.20	1.80	1.44	2.16	1.80	2.70	2.40	3.60
121 " 130	1.30	1.95	1.56	2.34	1.95	2.93	2.60	3.90
131 " 140	1.40	2.10	1.68	2.52	2.10	3.15	2.80	4.20
141 " 150	1.50	2.25	1.80	2.70	2.25	3.38	3.00	4.50
151 " 160	1.60	2.40	1.92	2.88	2.40	3.60	3.20	4.80
161 " 170	1.70	2.55	2.04	3.06	2.55	3.83	3.40	5.10
171 " 180	1.80	2.70	2.16	3.24	2.70	4.05	3.60	5.40
181 " 190	1.90	2.85	2.28	3.42	2.85	4.28	3.80	5.70
191 " 200	2.00	3.00	2.40	3.60	3.00	4.50	4.00	6.00

Night Messages.

Night messages are accepted at the following rates.

NIGHT MESSAGE RATES.

Where the Day Rate is	The Night Rate is
20—1	20—1
25—2	25—1
30—2	25—1
35—2	25—1
40—3	30—2
50—3	40—3
60—4	50—3
65—4	50—3
75—5	50—3
75—5	60—4
75—5	75—5
85—6	60—4
85—6	85—6
90—6	60—4
1.00—7	75—5
1.00—7	1.00—7
1.15—8	1.00—7
1.25—8	1.00—7
1.25—8	1.25—8

Night Letters or "Lettergrams."

Both of the large telegraph companies have inaugurated the night service which has been highly useful to the public, and which serves to utilize lines at night which would otherwise be idle.

Night lettergrams may be accepted for all offices in the United States and Canada, and also including many telephone points.

The charge for night lettergrams of fifty words or less will be the regular day rate for ten words, and one fifth (⅕) of this rate will be charged for each additional ten words or less.

Night lettergrams must be written in plain English. Code or cipher is not permitted. Night lettergrams should be written on special night lettergram blanks. Night lettergrams will be delivered as early as convenient the next morning. Night lettergrams may, at the option of the Telegraph Company, be mailed at destination to the addressees, and the Company shall be deemed to have discharged its obligation in such cases with respect to delivery by mailing such night lettergram at destination, postage prepaid. The instructions that night lettergrams must be written in "plain English language" do not disqualify words of an artificial character representing trade names or terms, trade designations of cotton shipments, brands or grades of flour, and other manufactured products. Trade names and trade designations are accepted without question, *provided they are used in their natural sense*, and are *not* used to convey a hidden meaning as code or cipher words do. For example, the expression "Uneeda" is the name of a product of a biscuit company. "XXX" is used to express a certain brand or grade of flour. "FHC," "AFC," "HLPH," represent cotton shippers' brands.

The combined telegraph and telephone service is proving very useful. The plan is to allow those telephone subscribers whose local telegraph office is closed for the night to call up "Central" and send a telegraph message which "Central" will transmit to the next telegraph office. This plan was found to be so advantageous that it is now possible to send telegrams day or night. If the service of the Western Union Co. is desired it is only necessary to say "Western Union." The Postal Telegraph must be asked for by name also.

Money by Telegraph.

All telegraph companies accept orders, both domestic and foreign, for immediate transfer of money by telegraph and cable. It is sometimes imperative to obtain large or small sums at the shortest possible moment, certainly within twenty-four hours. Formerly this branch of the business was in the hands of bankers, but now the cable companies and telegraph companies are able to pay money in places all over the world. The organization of telegraph and cable companies is a most complicated one, and there are many factors which control the rates. In general it may be stated that money can be sent anywhere in the United States at a premium of one per cent., minimum charge twenty-five cents, plus twice the price of a ten-word day message. For money sent abroad the premium is one per cent. with a minimum charge of fifty cents, plus of course the cable tolls, which will vary with the length of address, etc. Fullest possible information can be obtained at any telegraph office where a special tariff book may be consulted. For some countries, such as those in Central and South America, the expense is much greater than we have noted.

The British Postmaster-General has entered into an agreement with the Western Union Telegraph Company for an exchange through that company so they will telegraph money-orders between the United Kingdom on the one hand and Canada and the United States on the other after January 1, 1910. The largest amount for which a single money-order may be issued in the United Kingdom will be £40 sterling, but for orders issued in the United States and Canada for payment in the United Kingdom the largest amount is £41 1s. 4d., which is the equivalent of $200.

Miscellaneous Service.

Persons who wish to be notified of the arrival of steamers can make arrangements with the two telegraph companies to notify them of the arrival. The companies maintain signal stations at Fire Island, The Highlands, and Sandy Hook; also at Quarantine, for the purpose of reporting and sighting the arrival of steamers from foreign ports. To those who live in New York, or in nearby towns and cities, the notice will be received in ample time to reach the dock by the time the steamer warps in. The service for New York, New Jersey and Hoboken is $1.00. Parties in other places who are interested in incoming steamers can be notified by paying this fee of $1.00, plus the usual telegraph tolls for the ordinary ten-word message. For places not adjacent to New York, the notice conveys the intelligence of the near approach of home-coming steamers.

TOLLS ON MESSAGES OF FROM 10 TO 50 WORDS.

No. of Words.	Rate 20–1	Rate 25–1	Rate 25–2	Rate 30–2	Rate 35–2	Rate 40–3	Rate 50–3	Rate 60–4	Rate 75–5	Rate 100–7
10	20	25	25	30	35	40	50	60	75	100
11	21	26	27	32	37	43	53	64	80	107
12	22	27	29	34	39	46	56	68	85	114
13	23	28	31	36	41	49	59	72	90	121
14	24	29	33	38	43	52	62	76	95	128
15	25	30	35	40	45	55	65	80	100	135
16	26	31	37	42	47	58	68	84	105	142
17	27	32	39	44	49	61	71	88	110	149
18	28	33	41	46	51	64	74	92	115	156
19	29	34	43	48	53	67	77	96	120	163
20	30	35	45	50	55	70	80	100	125	170
21	31	36	47	52	57	73	83	104	130	177
22	32	37	49	54	59	76	86	108	135	184
23	33	38	51	56	61	79	89	112	140	191
24	34	39	53	58	63	82	92	116	145	198
25	35	40	55	60	65	85	95	120	150	205
26	36	41	57	62	67	88	98	124	155	212
27	37	42	59	64	69	91	101	128	160	219
28	38	43	61	66	71	94	104	132	165	226
29	39	44	63	68	73	97	107	136	170	233
30	40	45	65	70	75	100	110	140	175	240
31	41	46	67	72	77	103	113	144	180	247
32	42	47	69	74	79	106	116	148	185	254
33	43	48	71	76	81	109	119	152	190	261
34	44	49	73	78	83	112	122	156	195	268
35	45	50	75	80	85	115	125	160	200	275
36	46	51	77	82	87	118	128	164	205	282
37	47	52	79	84	89	121	131	168	210	289
38	48	53	81	86	91	124	134	172	215	296
39	49	54	83	88	93	127	137	176	220	303
40	50	55	85	90	95	130	140	180	225	310
41	51	56	87	92	97	133	143	184	230	317
42	52	57	89	94	99	136	146	188	235	324
43	53	58	91	96	101	139	149	192	240	331
44	54	59	93	98	103	142	152	196	245	338
45	55	60	95	100	105	145	155	200	250	345
46	56	61	97	102	107	148	158	204	255	352
47	57	62	99	104	109	151	161	208	260	359
48	58	63	101	106	111	154	164	212	265	366
49	59	64	103	108	113	157	167	216	270	373
50	60	65	105	110	115	160	170	220	275	380

CABLE LINES OF THE WORLD.

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SUBMARINE CABLES.

SUMMARY OF CABLES OWNED BY GOVERNMENT ADMINISTRATIONS.

Country.	Number of Cables with one or more cores.	Length in Nautical Miles. Of Cables.	Of Conductors.
Argentine Republic	22	84.000	240.000
Austria	83	681.300	685.000
Bahamas	1	211.000	211.000
Belgium	3[1]	76.454	366.432
Brazil	33	44.816	79.914
British Guiana	8	23 000	50.000
British India, Indo-European Telegraph Department Government Administration	157	1,988 652	1,988.652
Bulgaria (Widdin Cable)	1	0.538	0.538
Canada	27	344.250	344.250
Ceylon and India Joint	2	66 000	66.000
China	3[2]	955 400	955.400
Denmark (Telegraphs and Telephones)	142[3]	589 532[3]	1.750.399
France and Algeria	49[4]	2.596.070	2,680.244
France (Principal International and French Colonial Cables)	16	8,479.839	8,479.839
(French) Dahomey and Dependencies		1.078	1.078
Germany	97[1]	3,099.730	6,346.631
Great Britain and Ireland (see List of Cables)	216[1,2]	2,704 777	8,291.115
Greece	13	59.702	58.818
Holland	32	241.543	780.449
Inter-Colonial System	5	7.837.770	7,837.770
Italy	59	1,431.708	1,585.981
Japan	120	3,773.765	4,495.948
Mexico		488.520[3]	488.520
Netherlands (Indies)	17	2,741.900	2,741.900
New South Wales	283	71 712	328 928
New Zealand	34	364.627	370.335
Norway	803	1,102 981	1,860.383
Portugal	4	115.050	115.050
Queensland	25	53.510	56.930
Roumania		177.000	189.000
Russia in Europe and the Caucasus	21	896.660	1,056.910
Russia in Asia	1	12.340	12.340
South Australia	3	49.360	49.360
Spain	26	3,132.005	3,132.005
Sweden	26	196 496	346 361
Switzerland	2	10 685	15.057
Tasmania	4	4.500	11.500
Tunis		4 312	4.312
Turkey in Europe and Asia	24	460 844	479.637
Union of South Africa	2	6 614	14 501
Uruguay	1	8 000	8 000
Victoria	3	380 995	380 995
Western Australia	3	13.550	23.350
	2,321 1/2	45,529.585	58,980.832

[1]Including half of cables owned jointly with other Administrations. [2]Exclusive of Iceland with 13 cables of 17 nautical miles and 28 miles of conductors. [3]Including 20 miles of subfluvial cable. [4]Exclusive of several small river cables.

In 1887 the Western Union Telegraph Company had [illegible] 37,487 miles of line and 75,989 miles of wire. The same year they had only 2,535 offices. The next year the number of offices had increased to 2,565, and 5,870,282 messages were transmitted. For the year ending June 30, 1911, there were 210,220 miles of line, 1,487,145 miles of wire, and 24,926 offices. There were 177,780,732 messages sent, not including those over leased wires or under railroad contracts. The receipts amounted to $37,158,989 and the expenses were $30,053,632. The profits were $7,105,357, certainly not an exorbitant amount considering the value of the property involved. The average toll was 38.8 cents per message, and the cost of sending each message was 33.1 cents.

SUMMARY OF CABLES OWNED BY PRIVATE COMPANIES.

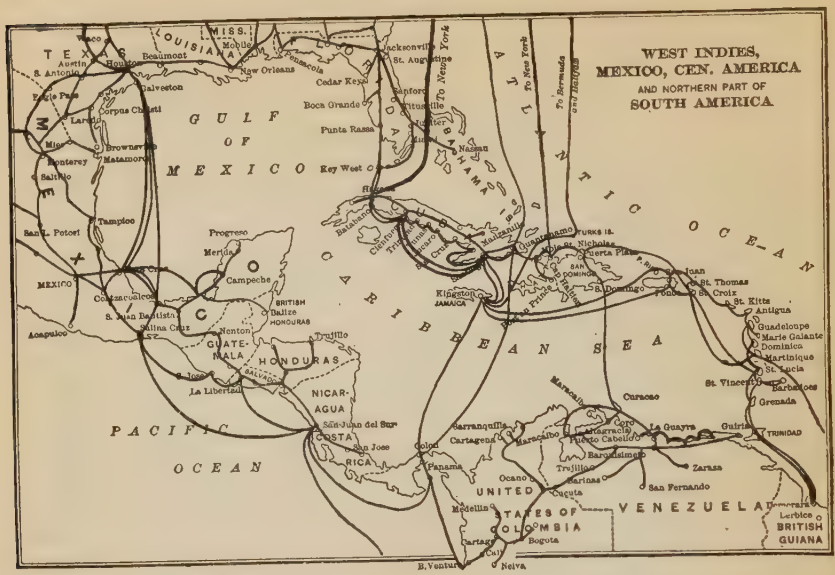
	Number of Cables with one or more cores.	Length of Cables in Nautical Miles.
African Direct Telegraph Company	9	3,026
Amazon Telegraph Company	19	1,304
Anglo-American Telegraph Company	18	9,548
Black Sea Telegraph Company	1	327
Canadian Pacific Railroad Company	10	102½
Central and South American Telegraph Company	21	11,793
Commercial Cable Company	15	16,585
Commercial Pacific	6	10,010
Commercial Cable Company of Cuba	1	1,285
Compagnie Française des Câbles Télégraphiques	24	11,430
Cuba Submarine Telegraph Company	10	1,143
Deutsch Atlantische Telegraphen-Gesellschaft	5	9,660
Deutsch-Niederlandische Telegraphen-Gesellschaft	3	3,416
Deutsch Sudamerikanische Telegraphen-Gesellschaft	3	5,811
Direct Spanish Telegraph Company	3	710
Direct United States Cable Company	3	3,171
Direct West India Cable Company	2	1,276
Eastern Telegraph Company	134	40,961
Eastern Extension, Australasia and China Telegraph Company	32	24,771
Eastern and South African Telegraph Company	16	10,060
Europe and Azores Telegraph Company	2	1,057
Great Northern Telegraph Company	29	8,039
Halifax and Bermudas Cable Company	1	851
Indo-European Telegraph Company	3	21
Mexican Telegraph Company	4	2,923
Osteuropäische Telegraphen-Gesellschaft	1	185
River Plate Telegraph Company	4	220
South American Cable Company	6	3,817
Spanish National Submarine Telegraph Company	1	927
United States and Hayti Telegraph and Cable Company	1	1,391
West African Telegraph Company	8	1,471
West Coast of America Telegraph Company	7	1,973
West India and Panama Telegraph Company	22	4,355
Western Telegraph Company[1]	43	23,848
Western Union Telegraph Company	8	7,351
Total	475	224,818½

GENERAL SUMMARY.

	Number of Cables with one or more cores.	Length of Cables in Nautical Miles.
Government Administrations	2,321½	45,530½
Private Companies	473	224,000½
Total	2,794½	269,531

Partly extracted from the Official Documents issued by the International Bureau of Telegraphic Administrations, Berne.—Electrical Trades Directory.

This table and that showing "Land Lines of the World" are the best obtainable, but are not believed to be free from error, as the footings in the original source of "Land Lines" were far from accurate, but these errors have been corrected by the Editor.



TELEGRAPH SYSTEM IN
ALASKA
ARCTIC OCEAN
NORTH PACIFIC OCEAN
BERING SEA
ASIA
ALASKA
NORTHWEST TERRITORIES
BRITISH COLUMBIA
U. S.
GULF OF ALASKA
BERING STRAIT
NORTON SOUND
KODIAK ISLAND
DIXON ENTRANCE
QUEEN CHARLOTTE ISD.
VANCOUVER ISD.
Port Hope
Nuwuk
Kobuk R.
Yukon R.
Fort Yukon
Fort Egbert
Eagle City
Circle City
Fort Hamlin
Tanana
Fort Gibbon
Fort Kenay
Fort Liscum
Fort Wrangel
Fort Simpson
Fort Stikine
Fort Rupert
Fort Tongass
Fort Rupert
Fort Simpson
Fort Stikine
Fort Wrangel
Fort Tongass
Fort Liscum
Fort Kenay
Fort Gibbon
Fort Hamlin
Fort Egbert
Fort Yukon
Kotzebue
Kotzebue Sd.
Prince of Wales
Point Barrow
Point Hope
Point Belcher
Point Franklin
Point Clarence
Point Hope
Point Belcher
Point Franklin
Point Barrow
Point Clarence
Kotzebue
Kotzebue Sd.
Kowak R.
Kowak
Kowak R.
Kowak
Kowak R.
Kowak

RULES FOR CABLE MESSAGES.

1. Every message must be prepaid, unless otherwise specially authorized, and all words in the address, text and signature are counted and charged for. No charge is made for the transmission of the name of the originating office.

ADDRESSES.

2. In the address of any message, the name of the office of destination, the name of the country and the name of the territorial subdivision are each counted as one word, no matter how many letters are employed.

3. The address of every message must consist of at least two words, the first indicating the name of the receiver and the second the name of the office of destination.

4. The sender is responsiole for an incorrect or insufficient address. Corrections and alterations can only be made by a paid service message.

5. No message can be accepted (except at "Sender's Risk") when addressed to the care of a registered address unless the words "care" or "care of," or their equivalent, be placed between the addressee's name, or destination, and the registered address; thus a message for "Meyer, Berlin," to be delivered to the registered address "Dervish, Berlin," should be addressed "Meyer, care (or 'care of') Dervish, Berlin."

6. If an indication of any particular route be given by the sender and considered necessary by the company, it will be forwarded free; such indication, when given, must be transmitted immediately after the address; that is, as a part of the address, and before the text of the message.

7. Messages destined for places beyond the lines of telegraph must contain instructions as to the name of the place from which they are to be posted. Such instructions must be inserted as a part of the address, and must be paid for.

PLAIN MESSAGES.

8. Plain messages (*i. e.*, neither Code nor Cipher) may be written in any language that can be expressed in Roman letters. In such messages each word of fifteen letters or less is counted as a word, and words of over fifteen letters are counted at the rate of fifteen letters or fractions of fifteen letters to a word.

CODE MESSAGES.

9. Code messages may contain words belonging to one or more of the following languages: English, French, German, Italian, Dutch, Portuguese, Spanish and Latin. The use of words of other languages is not allowed. Code messages may also contain artificial words—that is, groups of letters so combined as to be pronounceable in at least one of the eight admitted languages. In code messages each code word (whether genuine or artificial) of ten letters or less is counted as a word, and no code word of more than ten letters can be accepted. If any words in plain language, and of more than ten letters each, are used in code messages, they are counted at the rate of ten letters or fraction of ten letters to a word.

CIPHER MESSAGES.

10. In cipher messages, which may be composed of groups of figures or of groups of letters, the groups are counted at the rate of five figures or letters. or fraction thereof, to a word.

COUNTING OF WORDS, ETC.

11. Every isolated figure, letter or character counts as one word.

12. Words joined by a hyphen or separated by an apostrophe are counted as so many separate words.

13. Signs of punctuation, hyphens and apostrophes are not counted or sent except upon formal demand of the sender, in which case they will be charged for as one word each.

14. When the letters "ch" come together in the spelling of a word, they are counted as one letter. In artificial words, however, the combination is counted as two letters.

15. Abbreviated and misspelled words and illegitimate compound words and words combined in a manner contrary to the usages of any of the languages authorized by Rule 9, also unpronounceable groups of letters (not trade-marks or marks of commerce), are inadmissible, but if they should accidentally appear in a message the unpronounceable groups will be counted at the rate of five letters, or fraction of five letters, as one word, and the others in accordance with the number of words they actually contain.

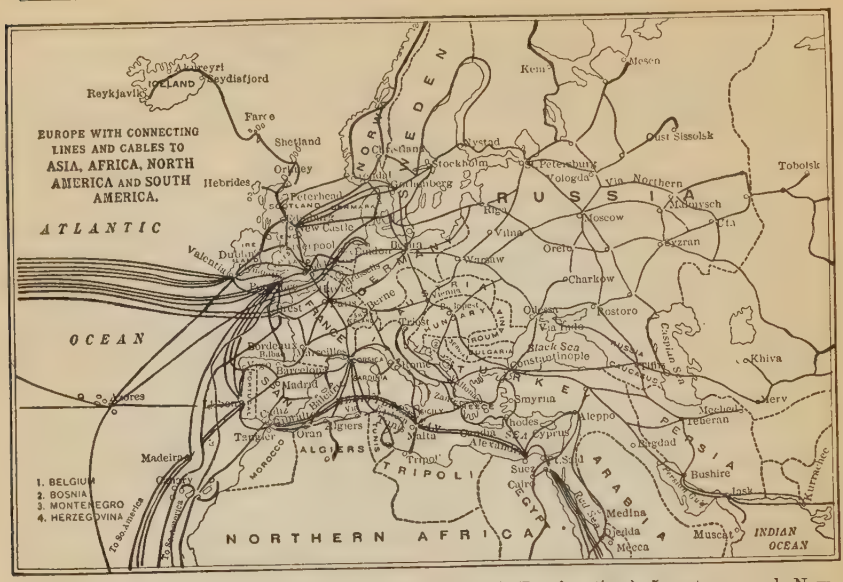
16. Inverted commas, the two signs of the parenthesis and each separate figure, letter or underline will be counted as one word. Groups of figures will be counted and charged for at the rate of five figures, or fraction thereof, as one word.

17. Decimal points and commas, used in the formation of numbers, also bars of division and letters added to figures to form ordinal numbers, are to be counted as a figure, and charged for at the rate of five figures, or fraction thereof, as one word.

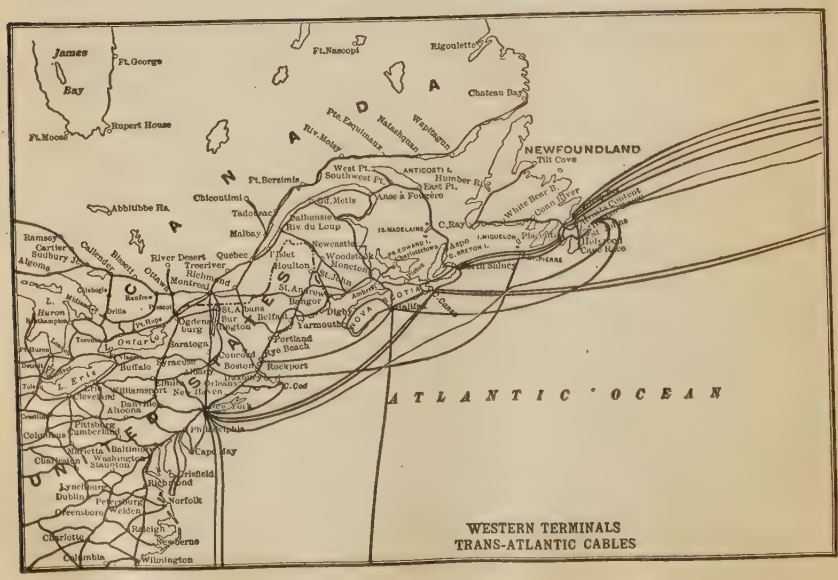
18. The following examples will determine the interpretation of the rules to be followed in counting:

	In the Text Words.	In the Address Words.
Alright	2	
Unconstitutional (16 letters)	2	
A-t-il	3	
Aujourdhui	1	
Aujourd'hui	2	
Newyork	1	
New York	2	1
Frankfort Main	2	1
Frankfurtmain	1	1
Starokonstantinow (Town in Russia)	2	1
Emmingen Wurtemberg	2	1
Van de Brande	3	
Vandebrande	1	
Dubois	1	
Du Bois	2	
Hyde Park	2	
Hydepark (contrary to usage of the language)	2	

(Continued on page 293.)



The general day and night press cable rate between London and New York is 7 cents a word, with the following reduction at certain hours: London to New York, 12 midnight to 6 A. M. (London time), 5 cents a word; New York to London, 12 midnight to 6 A. M. and 1 P. M. to 4 P. M. (New York time), 5 cents a word.



(Continued from page 291)

	In the Text Words.
Saintjames Street	2
Saint James Street	3
44½ (4 figures and sign)	1
444,55 (5 figures and sign)	2
$100	2
Onehundred dollars	2
10 fr. 50	3
11h 30	3
44	1
44/2	1
2%	1
Two hundred and thirty four	5
Twohundredandthirtyfour (23 letters)	2
State of Maryland (name of ship)	3
Stateofmaryland (name of ship)	1
Emvchf (6 letters)	2
Ch 23 (trade mark)	1
ap — " m	1
3 — " m	1
C. H. F. 45	2
The business is urgent, start at once (7 words and 2 underlines)	9
Send reply (if any) by mail (6 words and parentheses)	7
Explain "reversal" (2 words and inverted commas	3

REPETITIONS.

19. At the time of filing a message its sender may, upon payment of a quarter rate in addition to the ordinary tolls, order it repeated, in which case the various relay offices *en route* repeat it to each other as it passes. The words "REPETITION PAID," or the indication "T. C.," must be inserted immediately after the address; that is, as a part of the address and before the text, and is charged for.

The indication "T. C." counts as one word.

20. If repetition of a doubtful word or words be requested by the addressee of a message, the same may be procured by free service message to the office at which the message reached the lines, or to the CABLE DEPARTMENT, New York.

21. Every message exchanged between two telegraph offices to rectify a mistake o the sender is charged for at full rates.

ACKNOWLEDGMENT OF RECEIPT.

22. The sender may request that notice of the date and time at which his message is delivered to the addressee, or. when posted to destination, the date and time handed to the Post Office, be transmitted to him by telegraph or Postal Card. The words "ACKNOWLEDGMENT PAID," or the indication "P. C.," if notice is to be given by telegraph, or "P. C. P.," if notice is to be given by Postal Card, besides being transmitted in the check free, must be inserted immediately after the address, and is charged for. The indications "P. C." and "P C. P." count each as one word.

The charge for a telegraphic "acknowledgment of receipt" is equal to that for a message of five words to same destination by same route.

PREPAID REPLIES.

23. The sender of a message may pay for a reply thereto, but he must decide as to the length of the reply paid for. The indications "R. P." (meaning Reply Paid), together with the number of words prepaid, must be inserted in parentheses immediately before the address, that is, as a part of the address, and *is charged for*. The indication "R. P. 5," "R. P. 10," "R. P. 14," etc., counts as one word.

When accepting a message for which a reply *has been prepaid*, the originating office *will* collect, in addition to the charges therefor, the full charges for the reply as indicated.

The sender of such a message should understand that the toll paid for the reply is not a deposit, but is practically a remittance to his correspondent, to whom the foreign telegraph administrations deliver with the message a voucher specifying the amount and number of words paid for, which voucher entitles him to send free of charge, within the limits of the amount prepaid, a telegram to any destination whatever, and from any office of the administration whose office issued the voucher.

NIGHT CABLE LETTERS.

Night Cable Letters, accepted at any hour, are taken at the low rate of 75 cents for 12 words and 5 cents for each additional word, plus small additional charges beyond the cable stations and points of destination, if written in plain language of the country of origin or destination. They are deliverable at the convenience of the company within 24 hours o the time of filing.

It is necessary in every case to indicate whether mail or telegraphic delivery beyond London is to be made. This indication may be given by endorsing on the message if mailed, or transmitting in the check if wired, the designation "Lettermail" or "Letterwire" for cable letters to be mailed or wired respectively. To illustrate, a 12 word Cable Letter to Paris to be mailed from London would be checked "12 Lettermail."

All Cable Letters not destined to London or Liverpool will be mailed beyond London unless otherwise arranged by sender.

TABLE OF CABLE WORD RATES.

Following is a brief list of rates to some of the principal countries. The rate, of course, varies according to the location of the city or town in the United States. Thus, the rate from New York City to the Argentine Republic is 65 cents a word, while the rate from Mexico would be 74 cents a word. It is not feasible to give the rates from all of the states, as this can be readily obtained from the rate books of telegraph companies. The following rates give the cost per word from New York City:

Argentine Republic	$0.65
Australia and New Zealand	.66
Austria	.32
Barbados	.91
Belgium	.25

British Guiana	$1.44
Chili	.65
China	1.22
Cuba, Havana	.15
Cuba, other cities	.20
Denmark	.35
England	.25
France	.25
Germany	.25
Greece	.36
Holland	.25
Honolulu	.47
Hungary	.32
India	.74
Ireland	.25
Italy	.31
Jamaica	.48
Japan	1.33
Norway	.35
Panama Republic	.40
Peru	.65
Philippines (Manila)	1.12
Porto Rico	.50
Portugal	.39
Russia in Europe	.43
Scotland	.25
Spain, Prov. of Barcelona, Gerona, Lerida and Tarragona	.38
Spain, other offices	.40
Sweden	.38
Switzerland	.30
Turkey in Europe	.36
Uruguay	.65
Wales	.25

The rate from New York City to Great Britain, Ireland, France, Germany, Belgium and Holland is 25 cents a word. The rate in very few cases is increased more than 31 cents a word from inland places, except such states, etc., as Arizona, British Columbia, California, Idaho, Nevada, Oregon, Utah and Washington, where the rate is 37 cents per word. Arkansas, Colorado, most places in Florida, Iowa, Kansas, Louisiana, Manitoba, Minnesota, Missouri (other than St. Louis and a few other places), Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas and Wyoming have a rate of 34 cents a word. The rate from all the other states is 31 cents or less.

There are many places, particularly in Eastern, Northern and Southern Africa, which are very difficult to reach by cable or rather expensive and the rate is very high, amounting in some cases to as much as $4.86 per word. Any telegraph cable office will be glad to give specific information relative to such rates. The cable rates to the West Indies in some cases are very high, as for instance, British Guiana, where the rate is $1.44 per word. The rates to South America are apt to be very high, particularly to Peru. The rate to Bermuda from New York City is 42 cents per word; to Turk's Island, 56 cents per word.

If destined to points in Great Britain other than London or Liverpool the added charge for telegraphic delivery will be 12 cents for 12 words or less, cable count, and 1 cent for each additional word. If sent by telegraph to France the added charge will be 7½ cents per word, cable count; to Germany 9 cents per word, cable count; to Holland and Belgium 5 cents per word, cable count, and so on.

Plain English, or Anglicized foreign words in common use such as Chauffeur, Au revoir, etc., as used in a plain English message, may be accepted. No code words except those in registered addresses will be allowed.

Figures may be used in Cable Letters, and are counted as one word for each figure.

The indication "R. P." including the number of words prepaid is counted and charged for as one word.

The term "deferred rate" should not be used in connection with Cable Letters.

DEFERRED CABLE SERVICE

Commencing January 1, 1912, a deferred cable service was inaugurated subject to all the rules and regulations of the regular cable service with the following exceptions:

1. Messages must be in plain language, either French or the language of country of origin or destination authorized for international correspondence. The use of two or more languages in the same message is not permitted.

2. All numbers except those used in address must be written in words at full length.

3. The messages must contain at least one text word.

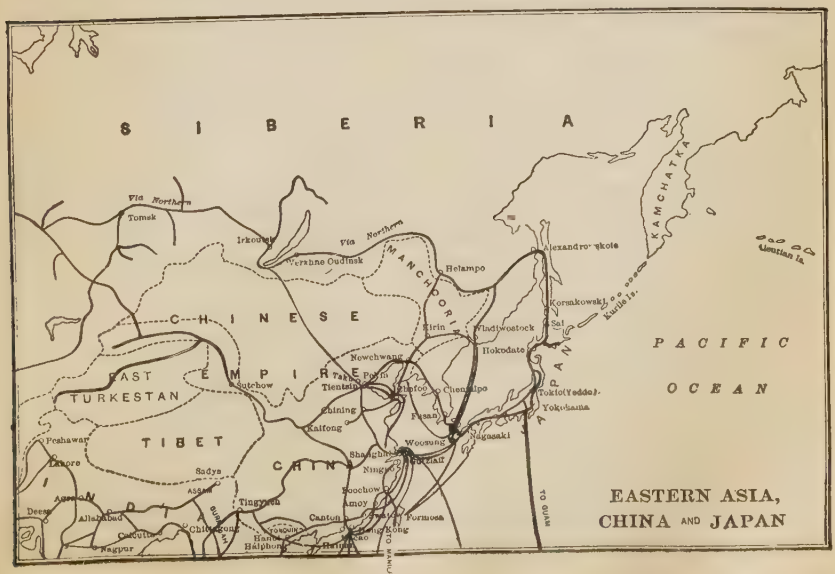
4. Senders must in every case write before the address and pay for as one word the letters LCF, LCO or LCD, as in the nature of a declaration that the communication is in the French language or the language of country of origin or destination as case may be.

5. Messages are liable to be deferred in favor of those paid for at full rates, for a period not exceeding 24 hours. If delayed beyond that time they take their turn with full paid traffic.

6. Rate charged for deferred cables is one-half the rate charged for full paid cables between the same terminals except between points in Great Britain and Ireland on the one hand and in the United States and Canada on the other, when the deferred rate is 3½ cents less than half the regular rate.

Aden, Arabia.
Algeria.
Argentine Republic.
Ascension Island.
Australia.
Austria.
Bathurst, British W. Africa.
Belgium.
Borneo (British).
Brazil
British East Africa.
Burmah.
Canary Islands.
Cape Colony.
Cape Verde Island.
Ceylon.
China:
  Amoy.
  Chefoo.
  Foochow.
  Hankow.
  Macao.
  Peking.
  Shanghai.
  Tientsin.
  Tsingtau.
  Weihaiwei.
Cocos Island.
Cyprus.
Denmark.
Egypt.
France.
French Guiana.
French Indo China.
French West Africa.
  French Soudan.
  Mauretania.
  Senegal.
Germany.
Gold Coast, Africa.
Great Britain and Ireland.
Greece.
Hungary.
Iceland.
India (British).
Italy
Labuan Island.
Luxemburg.
Madagascar.
Madeira Is.
Mauritius Island.
Morocco (except Casablanca, Mogador and Rabat).
New Zealand.
Nigeria.
Norway.

Bombay
Adem
Bellary
Dangalore
Madras
CEYLON
Galle
Rangoon
SIAM
ANAM
Bangkok
Penang
Labuan
Oleleb
SUMATRA
Padang
BORNEO
CELEBES
Hong Kong
Aparri
Manila
Punas
Jap
Guam
To San Francisco
PACIFIC OCEAN
NEW GUINEA
INDIAN OCEAN
JAVA
Cocos I.
Port Darwin
Paterson
NORTH AUSTRALIA
Kimberley
Cardwell
Townsville
Broome
WEST AUSTRALIA
QUEENSLAND
Charleville
Brisbane
Bundaberg
N. CALEDONIA
Noumea
New Hebrides
Fiji I.
SOUTH AUSTRALIA
Bourke
Tamworth
Norfolk I.
Perth
Eucla
Pt. Augusta
NEW SOUTH WALES
Sidney
Bunbury
Albany
Pt. Lincoln
Auckland
New Plymouth
Nelson
Wellington
Melbourne
Hobart
Invercargill
AUSTRALIA AND ISLANDS


SIBERIA
Via Northern
Tomsk
Irkoutsk
Via Northern
Verkhne Oudinsk
MANCHORIA
Helampo
Alexandrovskoie
KAMCHATKA
Ussurian Is.
CHINESE EMPIRE
Kirin
Vladivostock
Sel
Korsakowski
Kurile Is.
Hokodate
PACIFIC OCEAN
Newchwang
Peking
Tientsin
Chefoo
Chemulpo
Tokio (Yeddo)
Yokohama
Chining
Fusan
Nagasaki
EAST TURKESTAN
Kiaotchow
Kaifong
Peshawar
TIBET
Woosung
Shanghai
Ningpo
Foochow
Amoy
Formosa
Hong Kong
Canton
Tingyuen
Sadya
Assam
Agra
Allahabad
Calcutta
Chittagong
Nagpur
Hankow
Ichang
Halphong
Haiphong
TO BANGKOK
EASTERN ASIA, CHINA AND JAPAN

Orange River Colony.
Perim Island.
Portugal.
Portuguese East Africa.
Portuguese West Africa.
Rhodesia.
(Southern).
Rodrigues Island.
St. Helena Island.
Servia.
Sierra Leone.
Somaliland (British).
Spain.
Straits Settlements and Malay States.
Sweden.
Switzerland.
Tasmania.
Transvaal.
Tunis
Zanzibar.

WEEK END LETTERS

Week End Letters filed before midnight Saturday are deliverable the following Monday morning. The rate is $1.15 for 24 words and 5 cents for each additional word, plus small additional charges between the cable stations and points of destination. Week end letters must be written in plain language of the country of origin or destination.

It is necessary in every case to indicate whether mail or telegraphic delivery beyond London is to be made. This indication may be given by endorsing on the message if mailed or transmitting in the check if wired, the designation "Weekmail" or "Weekwire" for week end letters to be mailed or wired respectively.

Week End Letters so transmitted or mailed will be delivered on the following Tuesday morning after they leave New York, Boston or Montreal, or as soon thereafter as possible, distance considered if mailed beyond London or Liverpool.

All Week End Letters not destined to London or Liverpool will be mailed beyond London unless otherwise arranged by sender.

If destined to points in Great Britain other than London or Liverpool the added charge for telegraphic delivery will be as given under "Cable Letters," same rules also apply for words, etc.

A nine-word message has been despatched from a newspaper office in New York back to the starting point, the lapse of time being exactly sixteen and one-half minutes. The message traveled via Honolulu, Manila, Hong Kong, Singapore, Bombay, Suez, Gibraltar and the Azores.

The first telegraph line in the United States was opened for business in 1844; the telephone was introduced in 1876 by Prof. A. G. Bell.

THE FIRST ATLANTIC CABLE.

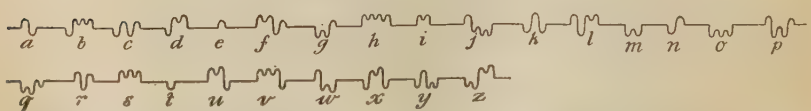
August 5th of 1908 was the fiftieth anniversary of the Atlantic Cable, that being the day of the month in 1858 on which—contrary to authoritative opinion—the engineer of one of the greatest achievements of the nineteenth century completed the laying of the submarine line between Ireland and Newfoundland, the length being over two thousand miles, and the depth nearly three miles for the greater part of the distance. The projectors were Mr. John Watkins Bright, Mr. (afterwards Sir Charles) Bright and Mr. Cyrus West Field. Mr. Bright was also the engineer-in-chief of the undertaking, and he received the honor of knighthood in recognition of his services to the country in connection therewith, at the unprecedented age of 26.

Electrical theories were, however, mistaken at that time, and the electricians applied far too much power for the transmission of signals, the result being that the insulation suffered by degrees, until after three months' useful work the cable gradually succumbed.

After a number of cables had been laid by Sir Charles Bright, Mr. H. C. Forde, Sir William Siemens and others to India, Gibraltar, Alexandria, &c., another Atlantic Cable expedition started in 1865. This was the first line that was laid by the manufacturers of the cable, these contractors being the Telegraph Construction and Maintenance Company, with Mr. (afterward Sir Samuel) Canning for their chief engineer, whilst Sir Charles Bright and Mr. Latimer Clark acted as consulting engineers to the proprietors. Notwithstanding the extra knowledge and experience gained in regard to the subject generally, this expedition met with as many mishaps as the first expedition of 1857; but in 1866—as in 1858—the same arrangements ultimately achieved success, since which the construction, laying, and working of submarine telegraphs has passed from the pioneer stage to that of ordinary routine.

The engineering methods were similar to those adopted eight years previously; but the line proved a lasting success, owing to the advances made in electrical science and in the practical working of cables. On the electrical side, in addition of the late Lord Kelvin, the names of Varley and Willoughby Smith must always be honorably associated with the subject, and the late Sir John Pender did more than any man for the commercial development of submarine telegraphy.

THE CABLE ALPHABET.



The cut above shows the Morse Code as recorded by a syphon recorder. Syphon recorders are used for receiving cable messages. It will be observed that the spaces are represented by horizontal lines, dots by loops above the space lines, and dashes by loops below the space lines.

ATLANTIC OCEAN
INDIAN OCEAN
WEST COAST
EAST COAST
SOUDAN
ARABIA
SOUTH AFRICA
Timbuctoo
St. Louis
Dakar
Bathurst
Bissao
Conakry
Kankan
Sierra Leone
Monrovia
Lagos
Bonny
Cameroons
Principe
St. Thomas
Libreville
Loanda
Benguela
Mossamedes
St. Helena
Ascension I.
Fernando Noronha
Pernambuco
Bahia
Cape Verde
St. Vincent
Via Lisbon
Via Madeira
Souakin
Massowah
Assab
Aden
Obok
Zeila
Berbera
Harar
Ankober
Shoa
Gondar
Abyssinia
Magdala
Adowa
Kassala
Khartoum
Metemma
Dongola
Berber
Abu Hamed
Shendy
Sennaar
Fazoglo
Gallabat
Suakim
Tokar
Kordofan
Darfour
Wadai
Bornou
Sokoto
Timbuctoo
Soudan
Egypt
Cairo
Alexandria
Suez
Mecca
Medina
Red Sea
Nile
Abyssinia
Nubia
Libya
Tripoli
Algeria
Morocco
Fez
Tangier
Gibraltar
Mediterranean Sea
Malta
Sicily
Italy
Rome
Naples
Turkey
Constantinople
Smyrna
Greece
Athens
Crete
Europe
Asia
Africa
Arabia
Persia
India
China
Japan
Australia
New Zealand
Pacific Ocean
Atlantic Ocean
Indian Ocean
Red Sea
Mediterranean Sea
Black Sea
Caspian Sea
Aral Sea
Lake Victoria Nyanza
Lake Tanganyika
Lake Nyassa
Lake Chad
Lake Ngami
Victoria Falls
Zambesi River
Niger River
Congo River
Orange River
Limpopo River
Transvaal
Orange Free State
Cape Colony
Natal
Zululand
Basutoland
Bechuanaland
Damaraland
Ovampoland
Angola
Portuguese East Africa
German East Africa
British East Africa
Uganda
Abyssinia
Somaliland
Arabia
Persia
India
Ceylon
Burmah
Siam

. . .
S
"SAVE"

_ _ _
O
"OUR"

. . .
S
"SOULS"

WIRELESS ROOM OF U. S. REVENUE CUTTER "GRESHAM."

CHAPTER X.

WIRELESS TELEGRAPHY.

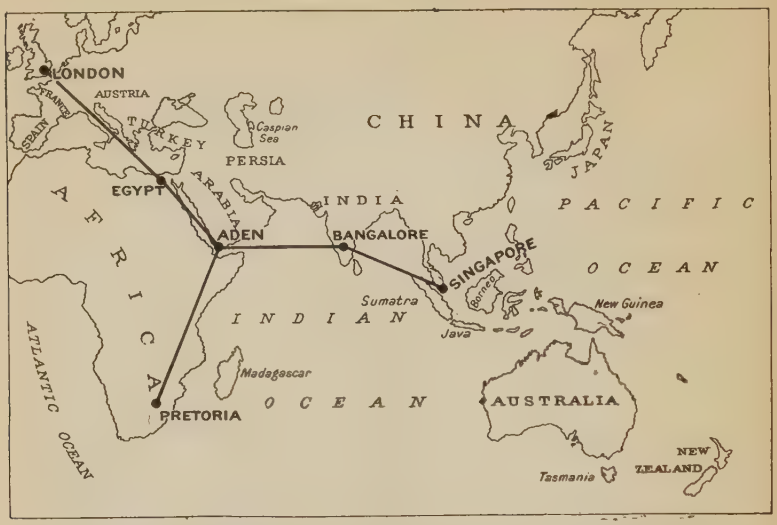
Wireless telegraphy is, in theory, closely allied to heliography, or signaling with flashes of light. The light used, however, is produced electrically and is invisible to the naked eye, owing to the fact that it is made up of very long waves, called Hertzian waves, which vibrate too slowly to affect the retina. The eye can only discern waves which make from 4,000 billions to 7,000 billions vibrations per minute. However, the Hertzian ray resembles light in that it can be reflected by a metallic plate and can be refracted by a prism of pitch, can be brought to a focus with a pitch lens, and may be polarized. Owing to the great length of the Hertzian waves, almost all substances are transparent to them. The Hertzian waves were discovered by Professor Heinrich Hertz, a young German philosopher, during his experiments with the spark discharge of Leyden jars and of the Ruhmkorff coil in 1886 and 1887.

He found that when a spark leaped the gap between the terminals, electric oscillations took place in these terminals which set up magnetic waves in the surrounding space, capable in turn of setting up similar oscillations in any adjacent conductor lying at an angle to them. The waves were detected by using a "resonator," which was merely a circle or a rectangle of copper wire formed with a gap in one side. When the induction coil was in operation and the resonator coil was held near the coil, a tiny stream of sparks would leap across the resonator gap. To better understand this phenomenon take as a crude example two vertical rods in a pool of water and on each a float free to slide vertically on the rod. Now, if one of these floats be moved up and down upon its rod, it produces waves in the water just as the electric oscillation produces waves in the ether. These spread out in all directions and on reaching the other float cause it to oscillate up and down, just as the magnetic waves produce electric oscillations in the resonator.

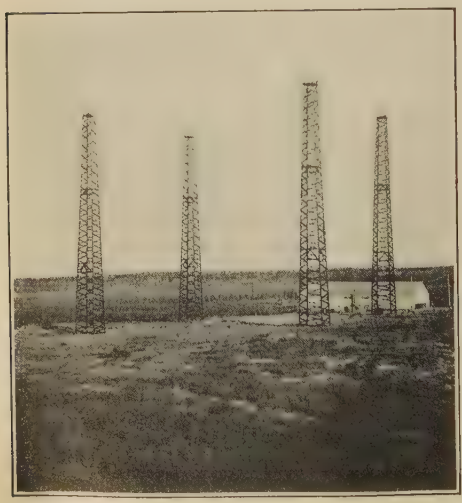
Without going into a detailed history of the development of wireless telegraphy from Hertz's experiments, it may be stated that the essential difference between the apparatus used by Hertz in his experiments and the several systems now commonly in use lies in the receiver. The transmitter is practically the same. A vertical wire called the antenna is connected to one terminal of the coil, and the other terminal is connected with the earth, the purpose being to increase the electrical capacity of the terminal rods and produce larger waves. Instead of producing the oscillations by means of an induction coil, they are now ordinarily produced by a dynamo and a step-up transformer except for telegraphing over short distances. But even with these changes we would not be able to telegraph over any appreciable distance if dependent upon the Hertz resonator for receiving a message, for, owing to the fact that the waves spread out in all directions from the transmitting antenna, the receiving antenna is acted upon by a very small proportion of the power expended by the transmitter, and this proportion decreases very rapidly as the distance between the transmitter and the receiver increases. In order then to detect the rays at long distances, a very sensitive instrument called the "coherer" has been invented. The coherer in its usual form consists of a glass tube with two metal pistons fitted therein between which a quantity of nickel filings is placed. The latter forms an imperfect electrical contact between the pistons, and takes the place of the spark gap in the receiving antenna. When the oscillations are set up in the antenna by the Hertzian waves, due to their high pressure or voltage, they break through the imperfect contact of the coherer, causing the filings therein to cohere or string together and thus produce a much better electric path through the coherer. The action is microscopic and cannot be detected with the naked eye. However, the coherer, aside from being a part of the antenna circuit, is also made a part of a local battery circuit, which contains a telegraph receiver, and whenever the electric oscillations open a good path through the filings for the local circuit, the telegraph instrument will be energized by the local battery only. In order to break this path after the oscillations have ceased, or, in other words, to cause the filings to decohere, they are constantly jarred apart by means of the "tapper," which is in reality an electric bell with the gong removed and the clapper striking the coherer tube instead. Carbon granules may be substituted for metallic filings, and in this case no tapper is necessary, the coherer being self-restoring.

In transmitting messages a telegraph key in the primary circuit of the induction coil is operated according to the usual Morse code, and this causes sparks to leap the spark gap at corresponding intervals. These signals will then be transmitted by the Hertzian waves to the receiving station, where they will be recorded by the telegraph receiver. The coherer is not by any means the only wave detector in use. Every wireless telegraph company has one or more different types of detectors.

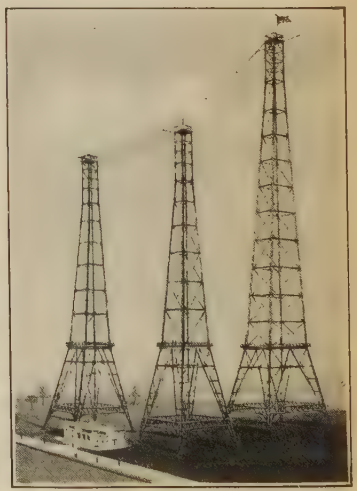
The Dover-Calais and Folkestone-Boulogne turbine steamers have been equipped with the Marconi wireless apparatus. The expense for telegrams from the ship to any part of England is 6 cents, with a minimum charge of 62 cents; to any part of France, Germany or Belgium, 9 cents a word; to Switzerland, Italy and Austria, 10 cents a word, and to Denmark, Sweden and Norway, 11 cents a word, with a minimum charge in each case of 75 cents.



MARCONI WIRELESS STATIONS FOR THE IMPERIAL TELEGRAPH SERVICE.



MARCONI HIGH POWER STATION AT SOUTH WELLFLEET, MASS, (CAPE COD.)



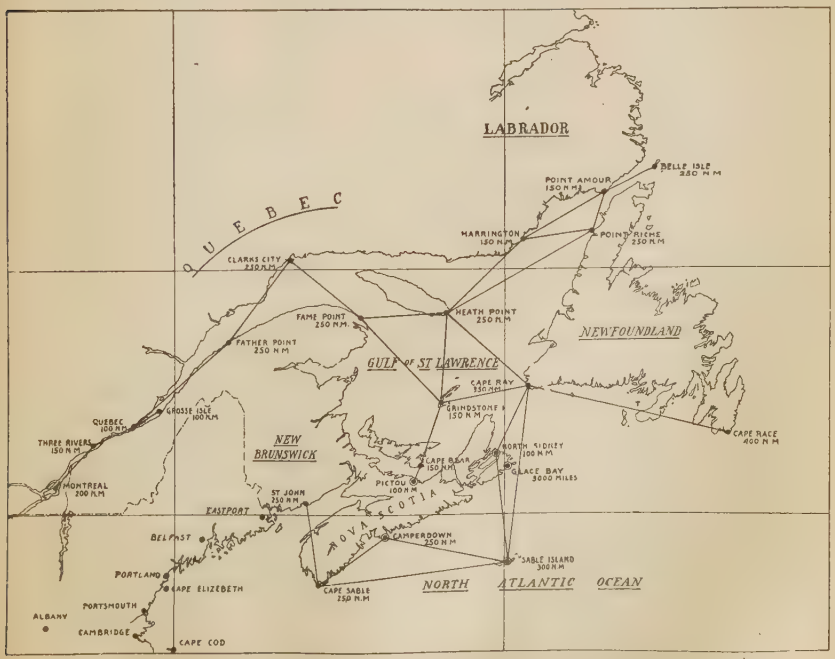
NAVY STATION AT ARLINGTON, VA.
Observed time will be sent out regularly from this station.

WIRELESS STATIONS.

A complete list of wireless telegraph stations of the world, including shore stations, merchant vessels, revenue cutters and vessels of the United States Navy, is published periodically by the Bureau of Steam Engineering of the Department of the Navy. The edition for January 1, 1912, consists of 165 pages. Copies of this publication can be obtained from the Superintendent of Documents, United States Printing Office, Washington, D. C., at a cost of 15 cents. The section devoted to wireless telegraphy in this book as regards the United States is taken from this work and is corrected to June 12, 1912, but many who would like to have the call letters, etc., of foreign wireless shore stations, also the call letters, etc., of vessels of the United States Navy, the United States Army, revenue cutters, and all steamships which are equipped with wireless, should purchase this inexpensive pamphlet. Space forbade the publication of this list in full.

Wireless communication was an established fact for more than ten years before the ships "Republic" and "Florida" collided on January 23, 1909. The wonderful salvage operation which was only rendered possible by the prompt action of the vessel summoned by wireless called instant attention to the importance of wireless as a safeguard from the dangers of the sea. The "Republic" might have gone down to the bottom without news of the disaster and with none of the passengers and crew saved, except possibly a few of them who escaped by life boats, had it not been for this most practical invention. It was two days after "La Bourgoyne" sank before the story of the catastrophe became known. The next interesting use of the wireless was perhaps the detection and arrest of Dr. Crippen for the crime of murder. There is no more weird story in the annals of crime than how the unseen wireless brought Dr. Crippen to the noose. Stations that were practically unknown became suddenly vitalized, and to-day Cape Sable, Belle Isle, Fame Point and Father Point are household words.

On the 14th of April, at 11.46 P. M., ship's time, the "Titanic" struck an iceberg. Within fifteen or twenty minutes the Captain visited the wireless room and instructed the operator to get assistance. The two calls "C.Q.D." and "S.O.S." began to flash from the aerials, and the message of despair from the sinking vessel was heard by the "Mount Temple," the "Frankfurt" and the "Carpathia." The Captain of the "Carpathia" immediately turned around and succeeded in reaching the "Titanic" after she sank, and rescued a portion of her passengers and crew. Had it not been for the wireless the probabilities are that very few, if any, survivors would have remained to tell the awful tale.



WIRELESS STATIONS IN THE UNITED STATES AND CANADA. A GREAT CENTER OF WIRELESS ACTIVITY.

WIRELESS TELEGRAPH SHORE STATIONS OF THE UNITED STATES AND CANADA.

Name and Location of Station.	Call Letters.	Range in Nautical Miles.	Power in Kilowatts.	Wave Length in Meters.	Character of Station.
UNITED STATES.					
ATLANTIC AND GULF COASTS.					
Eastport, Me.	WQ	400–1,000	5	800–1,500	Commercial.
Portland, Me.	NAB	.....	4	1,000	Gov. (Navy).
Fort Levitt, Me.	FV	.....	1	.....	Gov. (Army).
Portsmouth, N. H.	NAC	.....	2	1,000	Gov. (Navy).
Amesbury, Mass.	HY	.....	2	.....	Experimental.
Cambridge, Mass.	.....	.....	1	.....	Do.
Fort Andrews, Mass.	FC	.....	1	.....	Gov. (Army).
Brant Rock, Mass.	FBO	.....	7½ and 100	Variable.	Experimental.
Chatham, Mass.	AU	.....	5	480	Commercial.
Chelsea, Mass.	MU	.....	.....	.....	Experimental.
Boston, Mass.	FBN	.....	5	Variable.	Do.
Boston, Mass.	NAD	.....	5	1,000	Gov. (Navy).
Boston, Mass.	WSA	.....	5	Variable.	Experimental.
Cape Cod, Mass.	NAE	.....	5	1,000	Do.
Cape Cod, South Wellfleet[1]	MSW	.....	.....	.....	Commercial.
Cape Cod, Mass.	MOO	.....	35	1,500	Do.
Siasconsett, Mass.	MSC	.....	2	350	Do.
Quincy, Mass.	BH	400–1,000	2	550	Do.
Quincy, Mass.	.....	.....	.....	.....	Private.
Nantucket Shoals Lightship.	NLA	.....	2	400	Gov. (Navy).
Newport, R. I.	NAF	.....	5	1,000	Do.
Providence, R. I.	HG	.....	.....	.....	Commercial.
Point Judith, R. I.	PJ	.....	2	325	Do.
Block Island, R. I.	BI	.....	¼	280	Private.
New London, Conn.	WS	.....	5	480	Do.
Sea Gate, N. Y.	MSE	.....	.....	350	Do.
Sagaponack, N. Y.	MSK	.....	2	350	Do.
Fire Island, N. Y.	NAG	.....	7	1,000	Gov. (Navy).
N. Y. (42 Broadway)	NY	180–500	2	350–1,000	Commercial.
N. Y. (111 Broadway)	TWT	.....	.....	425	Do.
N. Y. (Wanamaker's)	MHI	.....	.....	.....	Private.
N. Y. (Herald, Battery)	OHX	.....	2	640	Do.
N. Y.	FNK	.....	2	3,000	Experimental.
Brooklyn, N. Y.	NAH	.....	15	1,000	Gov. (Navy).
Fort H. G. Wright, N. Y.	FW	.....	1	.....	Gov. (Army).
Fort Totten, N. Y.	FT	.....	1	.....	Do.
Fort Wood, N. Y.	FD	.....	3	.....	Do.
Fort Hancock, N. J.	FN	.....	1	.....	Do.
Atlantic City, N. J.	AX	300–600	2	700	Do.
Cape May, N. J.	MCY	.....	.....	.....	Do.
Camden, N. J.	BS	150–500	2	550	Do.
Philadelphia, Pa. (Wanamaker's)	MHE	.....	.....	.....	Private.
Philadelphia, Pa. (Bellevue-Stratford)	BS	500	2	550	Commercial.
Philadelphia, Pa.	NAI	.....	3	1,000	Gov. (Navy).
Cape Henlopen, Del.	NAJ	.....	2	1,000	Do.
Sparrows Point, Md.	B	350	5	750	Commercial.
Annapolis, Md.	NAK	.....	2	1,000	Gov. (Navy).
Washington, D. C.	NAL	.....	5	1,000	Do.
Washington, D. C.	QK	.....	2	.....	Experimental.
Washington, D. C. (Mills Building)	SC	.....	3	.....	Gov. (Army).
Washington, D. C. (Bureau of Standards)	BS	.....	2	.....	Do.
Arlington, Va.[2]	NAV	.....	100	.....	Gov. (Navy).
Fort Monroe, Va.	FO	.....	1	.....	Gov. (Army).
Fort Monroe, Va.	CAS	.....	2	.....	Do
Norfolk, Va.	NF	150	2	580	Commercial.
Norfolk, Va.	NAM	.....	5	1,000	Gov. (Navy).

[1] High Power Marconi Station.
[2] Under construction three large wireless towers.

WIRELESS TELEGRAPH SHORE STATIONS OF THE UNITED STATES AND CANADA.—Continued.

Name and Location of Station.	Call Letters.	Range in Nautical Miles.	Power in Kilowatts.	Wave Length in Meters.	Character of Station.
ATLANTIC AND GULF COASTS—Continued.					
Beaufort, N. C.	NAN	.....	5	1,000	Gov. (Navy).
Diamond Shoals	NLB	.....	1	400	Do.
Cape Hatteras, N. C.	HA	450–1,000	5	600	Commercial.
Charleston, S. C.	NAO	.....	5	1,000	Gov. (Navy).
Frying Pan Shoals	NLC	.....	2	400	Do.
Savannah, Ga.	SV	150–600	2	450	Commercial.
Jacksonville, Fla.	JX	150–300	2	600	Commercial.
St. Augustine, Fla.	NAP	.....	2	1,000	Gov. (Navy).
Jupiter, Fla.	NAQ	.....	5	1,000	Do.
Key West, Fla.	NAR	.....	25 and 2	1,000–2,000	Gov. (Navy).
Tampa, Fla.	PD	500–1,500	5	600	Commercial.
Pensacola, Fla.	NAS	.....	5	1,000	Gov. (Navy).
Mobile, Ala.	MB	.....	2	400	Commercial.
Fort Morgan, Ala.	FM	100	2	350	Do.
New Orleans, La.	HK	300–500	5	500	Do.
New Orleans, La.	HB	700	5 and 25	1,750	Private.
New Orleans, La.	NAT	.....	5	1,000	Gov. (Navy).
Burrwood, La.	SW	75	1½	250	Private.
Grand Island, La.	GW	450–1,000	2	1,000	Commercial.
Port Arthur, Tex.	RU	200	2	450	Do.
Port Arthur, Tex.	MXI	.....	.....	.....	Do.
Galveston, Tex.	GV	200–400	2	450	Do.
Fort Sam Houston, Tex.[1]	SA	.....	10	.....	Gov. (Army).
INTERIOR.					
Fort Leavenworth, Kans.	FL	.....	3	.....	Do.
Fort Riley, Kans.	FP	.....	3	.....	Do.
Fort Omaha, Neb.	FS	.....	3	.....	Do.
GREAT LAKES.					
Buffalo, N. Y.	BF	75	2	Variable.	Commercial.
Erie, Pa.	CI	.....	5	.....	Do.
Ashtabula, Ohio	CO	.....	5	500	Do.
Cleveland, Ohio	CX	150	2	Variable.	Do.
Cleveland, Ohio	CN	.....	10	1,000	Do.
Toledo, Ohio	CT	.....	5	.....	Do.
Detroit, Mich.	DR	150	2	Variable.	Do.
Detroit, Mich.	CF	.....	.....	Variable.	Experimental.
Detroit, Mich.	CJL	.....	5	Variable.	Commercial.
Detroit, Mich.	CW	.....	5	750	Do.
Port Huron, Mich.	CH	.....	10	850	Do.
Bay City, Mich.	CY	.....	5	750	Do.
Saginaw, Mich.	CAN	.....	5	500	Do.
Mackinac Island, Mich.	HQ	100	2	Variable.	Do.
Ludington, Mich.	HX	150	2	Variable.	Do.
Harbor Beach, Mich.	BN	.....	2	Variable.	Do.
Isle Royal, Mich.	RO	.....	2	Variable.	Do.
Grand Haven, Mich.	GH	100	2	Variable.	Do.
Benton Harbor, Mich.	BH	100	2	Variable.	Do.
Chicago, Ill. (Hotel)	GO	150–200	2	Variable.	Do.
Chicago, Ill.	CG	.....	7½	900	Do.
Milwaukee, Wis.	MK	200	5	Variable.	Do.
Manitowoc, Wis.	MW	150	2	Variable.	Do.
Waupaca, Wis.	PA	.....	2	.....	Do.
Scandinavia, Wis.	SC	.....	1	.....	Do.
Sault Ste. Marie, Mich.	SH	250	5	Variable.	Do.
Marquette, Mich.	CQ	.....	7½	900	Do.
Frankfort, Mich.	FK	150	2	Variable.	Do.
Manistique, Mich.	AS	150	2	Variable.	Do.
Calumet, Mich.	CM	150	2	Variable.	Do.
Duluth, Minn.	DM	.....	5	Variable.	Do.
Grand Marais, Minn.	GM	150	2	Variable.	Do.

[1]Projected.

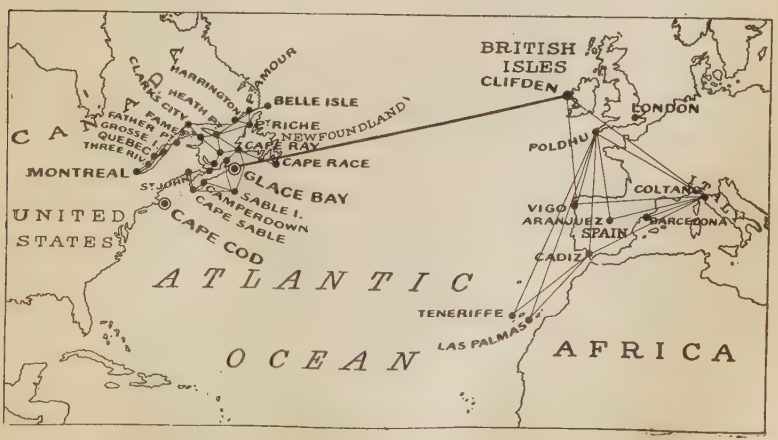
WIRELESS TELEGRAPH SHORE STATIONS OF THE UNITED STATES AND CANADA.—Continued.

Name and Location of Station.	Call Letters.	Range in Nautical Miles.	Power in Kilowatts.	Wave Length in Meters.	Character of Station.
PACIFIC COAST.					
Friday Harbor, Wash.	PD		2		Commercial.
Seattle, Wash.	PA		5	1,500	Do.
Seattle, Wash.	S2		5	500	Do.
Seattle, Wash.	HC		4		Private.
Roche Harbor, Wash.	RH		4		Do.
Bremerton, Wash.	NPC		5	1,000	Gov. (Navy).
Tacoma, Wash.	T2		2	400	Commercial.
Tatoosh Island, Wash.	NPD		5	1,000	Gov. (Navy).
North Head, Ilwaco, Wash.	NPE		10	1,000	Do.
Fort Worden, Wash.	FX		1		Gov. (Army).
Astoria, Oreg.	PC	200	2	425	Commercial.
Marshfield, Oreg.	PX		2		Do.
Fort Stevens, Oreg.	FJ		1		Do.
Cape Blanco, Denmark, Ore.	NPF		5	1,000	Gov. (Navy).
Eureka, Cal.	PM		5	425	Commercial.
Eureka, Cal.	NPG		5	1,000	Gov. (Navy).
Farallon Islands, Cal.	NPI		5	1,000	Do.
San Francisco, Cal.	PH		10	600	Commercial.
S. F., Cal. (Presidio)	PS		1		Gov. (Army).
Yerba Buena Island, S. F.	NPJ		2	600	Gov. (Navy).
Mare Island, Cal.	NPH		5	1,000	Do.
San Luis Obispo, Cal.	DN		2	100	Commercial.
Point Arguello, Surf, Cal.	NPK		3	1,000	Gov. (Navy).
San Pedro, Cal.	PJ		5	425	Commercial.
Los Angeles, Cal.	PJ		2	425	Do.
Los Angeles, Cal.	G2		2	500	Do.
Avalon, Cal.	A2		1	500	Do.
Avalon, Cal.	PI		2	425	Do.
San Diego, Cal.	NPL		5	1,000	Gov. (Navy).
ALASKA.					
Pribilof Islands	NPQ		3	1,000	Gov. (Navy).
Dutch Harbor	NPR		5	1,000	Do.
Unalga Island[1]	NPV		10	1,000	Do.
Kodiak	NPS		3	1,000	Do.
Cordova	NPA		10	1,000	Do.
Sitka	NPB		20	1,000	Do.
Circle City	FK		3		Do.
Fort Egbert	FG		5		Do.
Fairbanks	FB		5		Do.
Fort Gibbon	FG		10		Do.
Fort St. Michael	FM		3		Do.
Kotlik	FE		1		Do.
Nome	FD		10		Do.
Nulato	FU		10		Do.
Petersburg	FP		1		Do.
Wrangell	FW		1		Do.
Ketchikan	PB		2		Commercial.
Juneau	DU		2		Do.
Karluk	HA		5		Do.
Kogginung	HB		2		Do.
Chignik	HC		2		Do.
Nushagak	HF		2		Do.
Clarks Point	HG		2		Do.
Nak Nek	HT		5		Do.
CANADA.					
Indian Harbor, Labrador	MNR				Government.
Domino Island, Labrador	MDO	150		220	Do.
American Tickle, Labrador	MAT				Do.
Venison Island, Labrador	MVI	150		220	Do.
Battle Harbor, Labrador	MBH	150		220	Do.

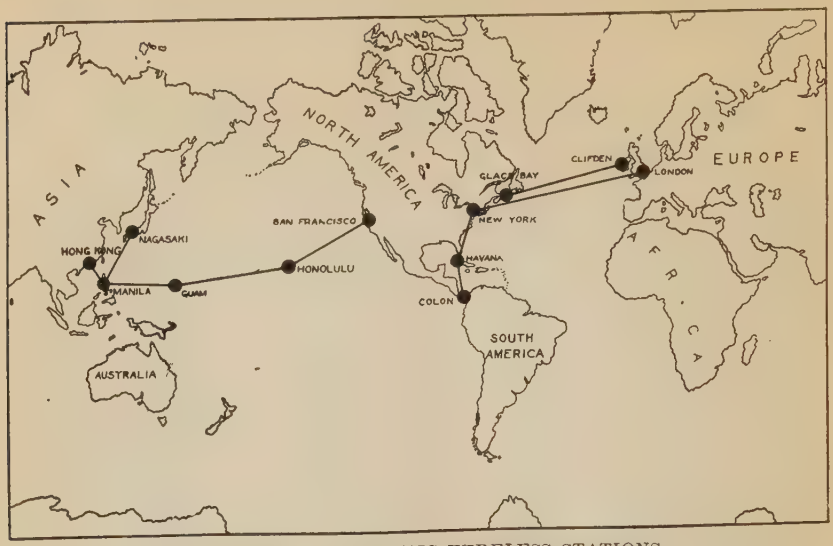
[1]Projected.

WIRELESS TELEGRAPH SHORE STATIONS OF THE UNITED STATES AND CANADA.—Continued.

Name and Location of Station.	Call Letters.	Range in Nautical Miles.	Power in Kilowatts.	Wave Length in Meters.	Character of Station.
CANADA—Continued.					
Chateau Bay, Labrador	MCB	.....	.....	.....	Government.
Belle Isle, Newfoundland	MBI	230	.....	600	Do.
Point Rich, Newfoundland	MCH	230	.....	600	Do.
Cape Ray, Newfoundland	MCR	270	.....	*600*, 1,600	Do.
Cape Race, Newfoundland	MCE	350	.....	*600*, 1,600	Do.
Harrington, Quebec	MWR	135	.....	300	Do.
Heath Point, Anticosti Isd	MHP	230	.....	600	Do.
Grindstone, Magdalen Isd	MUD	135	.....	600	Do.
Fame Point, Quebec	MFP	230	.....	600	Do.
Clarke City, Quebec	MCK	230	.....	600	Do.
Father Point, Quebec	MUA	230	.....	600	Do.
Grosse Isle, Quebec	MGI	100	.....	300	Do.
Quebec, Quebec	Q	100	.....	300	Do.
Three Rivers, Quebec	MUC	135	.....	600	Commercial.
Montreal, Quebec	MTL	190	.....	600	Do.
North Sydney	MND	135	.....	300	Do.
Cape Breton, Glace Bay	GB	.....	.....	.....	Government.
Pictou, Nova Scotia	MUB	100	.....	300	Do.
Camperdown, Nova Scotia	MHX	230	.....	600	Commercial.
Sable Island, Nova Scotia	MSD	300	.....	600	Government.
Cape Sable, Nova Scotia	MSB	230	.....	600	Do.
St. John, Partridge Island	MSJ	230	.....	600	Do.
Port Arthur, Ontario	MUG	350	.....	600	Do.
St. Thomas, Ontario	CST	.....	5	400	Commercial.
Prince Rupert, B. C.	PRD	250	.....	600	Government.
Dead Tree Point, B. C.	CAD	225	.....	600	Do.
Ikeda Head, B. C.	DKD	250	.....	600	Do.
Triangle Island, B. C.	TLD	350	.....	600	Do.
Cape Lazo, Vancouver, B. C.	SKD	175	.....	600	Do.
Estevan, Vancouver, B. C.	USD	100	.....	600	Do.
Point Grey, Vancouver, B.C.	PGD	100	.....	600	Do.
Pachena, Vancouver, B. C.	KPD	250	.....	600	Do.
Victoria, B. C.	VSD	200	.....	600	Do.



COMMERCIAL TELEGRAPH STATIONS CONSTRUCTED BY MARCONI'S WIRELESS TELEGRAPH CO. LTD., AND IN OPERATION.



MARCONI TRANS-OCEANIC WIRELESS STATIONS.

WIRELESS STATIONS IN EUROPE.

On June 12, 1912, there were 1,577 merchant ships equipped with wireless telegraph installations. The total number of commercial coast stations was 286.

Under the Imperial Wireless System all of the stations will be fitted with apparatus for the automatic transmission and receipt of messages, guaranteeing a speed of not less than fifty words a minute. Arrangements are progressing and the work will be carried out as expeditiously as possible for the construction of stations placing Great Britain in direct communication with New York, instead of having the messages pass through Glace Bay; also for the construction of stations in San Francisco for communication through the Hawaiian Islands with the Philippines, China and Japan. Arrangements are also being made for stations to send messages from New York south to Cuba, Panama, and subsequently to each South American State.

The New York *Times* has made more use of the wireless station than perhaps any other paper in the world, and nearly all of their foreign news in the Sunday edition is transmitted by wireless. When the new stations in London and New York are completed wireless messages will be received in less than ten minutes from the time of their dispatch, independent between these two points. When the stations are completed the Marconi Company will be independent of land lines and will provide a service which will not be surpassed for speed and accuracy. The world's rights in the wireless compass of Messrs. Bellini and Tosi has also been acquired by the Marconi Company. This will undoubtedly prove of considerable value when worked in conjunction with existing wireless installations aboard ships, enabling the Captain to define the position of an approaching ship or of the land in a dense fog.

The United States Navy is now planning the construction of a chain of wireless stations embracing two oceans and a continent within the range of this chain, so that naval vessels, whether near the African coast or in Chinese waters, will be under direct control from Washington by aerial communication. Funds for this plan were not forthcoming at the last session of Congress. The first section is now in course of erection at Arlington, Va., and will be ready shortly after the publication of this book. Each of the stations is to have a semi-radius of 3,000 miles or more.

The Arlington station consists of three steel towers in the form of an isosceles-triangle. At the apex of the triangle the tower is 650 feet high, or 95 feet higher than the tip of the Washington monument. At the base are two towers, each 450 feet in height. The antennae are to be strung from the tallest tower to the other two. These immense towers are striking features of the landscape as viewed from any point of vantage in Washington. It is contemplated to move all of our naval vessels by the use of these towers. The range of the Arlington station will cover practically all of the North Atlantic ocean. Guautana, Cuba, falls easily within the range of this station, and regular communication with the station to be erected at Panama will be had with equal facility

TRANSATLANTIC MARCONIGRAMS.

Marconigrams for transmission to Great Britain and Ireland and to ships at sea are accepted at all offices of the Western Union Telegraph Co. and the Great North-Western Telegraph Co.

The established rules and regulations governing the method of counting and charging of Cable Messages are applicable to Marconigrams.

RATES.

FROM TO	Great Britain and Ireland
Points in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York City, Yonkers, N. Y., Hoboken, Jersey City Union Hill, N. J., Points in the Maritime Provinces, New Brunswick, Nova Scotia and in the Eastern Canadian Provinces, Quebec and Ontario	$0.15
Delaware, Maryland, New Jersey, (except Hoboken, Jersey City and Union Hill,) New York (except New York City and Yonkers), Pennsylvania and the District of Columbia	.18
Alabama, Georgia, Illinois, Indiana, Kentucky, Michigan, Mississippi, North Carolina, Ohio, South Carolina, Tennessee, Virginia, West Virginia and Wisconsin, Pensacola, Fla., Burlington, Clinton, Cedar Rapids, Davenport, Dubuque, Ft. Madison, Keokuk and Muscatine, Ia., New Orleans, La., Duluth, Hastings, Lake City, Minneapolis, Redwing, St. Paul, Stillwater, Wabasha and Winona, Minn., Hannibal, La., St. Louis, Mo.	.21
Arkansas, Colorado, Florida (except Pensacola and Key West), Iowa (except Burlington, Clinton, Cedar Rapids, Davenport, Dubuque, Ft. Madison, Keokuk, and Muscatine), Kansas, Louisiana (except New Orleans), Manitoba, Minnesota (except Duluth, Hastings, Lake City, Minneapolis, Redwing, St. Paul, Stillwater, Wabasha and Winona), Missouri (except Hannibal, Louisiana and St. Louis), Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Wyoming	.24
Arizona, California, Idaho, Nevada, Oregon, Utah and Washington, Key West, Fla., Vancouver, Victoria and New Westminster, B. C.	.27

Deferred messages subject to a maximum delay of 24 hours and written in plain English language are also accepted at one-half these rates.

FULL MARCONI WIRELESS RATES TO AND FROM AND BETWEEN SHIPS.

SHIP TO SHIP.

The rate for messages sent from one ship to another is 16 cents per word (cable count) with minimum charge for ten words (address and signature counted).

VIA COASTAL STATIONS.

The following is the schedule of *word rates* effective November 1, 1912, for messages to and from ships via undermentioned stations—cable count, with minimum charge for ten words including address and signature. These rates include *all landline and delivery charges.*

Between all Offices in	and Ships via Coastal Stations at	New York City, N. Y. Sea Gate, N. J. Sagaponack, N. Y.	Boston, Mass. South Wellfleet, (short dist.) Mass.	*South Wellfleet, Mass.	Siasconset, Mass.	Eastport, Me.	Atlantic City, N. J.	Philadelphia, Pa.	Baltimore, Md.	Norfolk, Va.	Hatteras, N. C.	Charleston, N. C.	Savannah, Ga.	Jacksonville, Fla.	Tampa, Fla.	Key West, Fla.	Mobile, Ala.	New Orleans, La.	Galveston, Port Arthur, Tex.	San Francisco, Cal.	Seattle, Wash.
Alabama		$0.26	$0.27	$0.57	$0.38	$.027	$0.26	$0.26	$0.26	$0.25	$0.27	$0.25	$0.25	$0.25	$0.25	$0.30	$.23	$0.25	$0.25	$0.29	$0.29
Arizona		.29	.29	.59	.40	.29	.29	.29	.29	.29	.31	.29	.28	.29	.29	.34	.29	.28	.27	.26	.28
Arkansas		.26	.27	.57	.38	.27	.27	.27	.26	.26	.28	.26	.25	.25	.26	.30	.25	.25	.25	.29	.29
British Columbia		.29	.29	.59	.41	.29	.29	.29	.29	.29	.31	.29	.29	.29	.29	.34	.29	.29	.29	.26	.25
California		.29	.29	.59	.40	.29	.29	.29	.29	.29	.51	.29	.29	.29	.29	.34	.29	.29	.28	.24	.26
Colorado		.28	.28	.58	.39	.28	.28	.28	.28	.28	.30	.28	.28	.28	.28	.33	.28	.28	.26	.28	.28
Connecticut		.22	.22	.52	.33	.24	.24	.24	.24	.25	.27	.26	.26	.26	.27	.31	.27	.27	.28	.29	.29
Delaware		.23	.24	.54	.35	.25	.24	.22	.22	.24	.26	.25	.26	.26	.27	.31	.26	.26	.28	.29	.29
District of Columbia		.23	.24	.54	.35	.25	.24	.22	.22	.24	.26	.25	.25	.26	.26	.31	.26	.25	.28	.29	.29
Florida (ex. Key West)		.26	.27	.57	.38	.27	.27	.27	.27	.25	.27	.25	.25	.23	.23	.25	.25	.25	.26	.29	.29
Georgia		.26	.26	.56	.37	.27	.26	.26	.25	.25	.27	.25	.22	.25	.25	.30	.25	.25	.26	.29	.29
Idaho		.29	.29	.59	.40	.29	.29	.29	.29	.29	.31	.29	.29	.29	.29	.34	.29	.29	.28	.26	.25
Illinois		.25	.26	.56	.37	.26	.25	.25	.25	.25	.27	.26	.26	.27	.27	.32	.26	.26	.27	.28	.28
Indiana		.25	.25	.55	.36	.26	.25	.25	.25	.25	.27	.26	.26	.26	.26	.31	.26	.26	.27	.29	.29
Iowa		.26	.27	.57	.38	.27	.26	.26	.26	.26	.28	.26	.27	.27	.27	.32	.27	.27	.27	.28	.28
Kansas		.27	.28	.58	.39	.28	.27	.27	.27	.27	.29	.27	.27	.28	.28	.33	.27	.27	.26	.28	.28
Kentucky		.25	.26	.56	.37	.26	.25	.25	.25	.25	.27	.25	.25	.25	.26	.30	.25	.25	.26	.29	.29
Louisiana		.27	.27	.57	.38	.27	.27	.26	.26	.26	.28	.25	.25	.25	.25	.30	.22	.22	.25	.29	.29
Maine		.24	.23	.53	.34	.22	.25	.25	.25	.25	.27	.26	.27	.27	.27	.32	.27	.27	.28	.29	.29
Manitoba		.28	.28	.58	.39	.28	.28	.28	.28	.28	.30	.28	.28	.28	.28	.33	.28	.28	.28	.29	.28
Maryland		.23	.25	.55	.36	.25	.24	.23	.22	.24	.26	.25	.25	.26	.26	.31	.26	.26	.28	.29	.29
Massachusetts		.23	.22	.52	.33	.23	.24	.24	.24	.25	.27	.26	.26	.26	.27	.31	.27	.27	.28	.29	.29
Michigan		.25	.25	.55	.36	.26	.25	.25	.25	.25	.27	.26	.26	.27	.27	.32	.27	.27	.27	.29	.29
Minnesota		.26	.27	.57	.38	.27	.27	.27	.27	.27	.29	.27	.27	.27	.28	.32	.27	.27	.27	.28	.28
Mississippi		.26	.27	.57	.38	.27	.26	.26	.26	.25	.27	.25	.25	.25	.25	.30	.25	.24	.25	.29	.29
Missouri		.26	.27	.57	.38	.27	.26	.26	.26	.26	.28	.26	.26	.26	.27	.31	.26	.26	.26	.28	.28
Montana		.28	.28	.58	.39	.28	.28	.28	.28	.28	.30	.28	.28	.28	.28	.33	.28	.28	.28	.28	.27

Nebraska	.27	.28	.58	.39	.28	.27	.27	.27	.27	.29	.28	.28	.28	.28	.33	.27	.28	.26	.28	.28
Nevada	.29	.29	.59	.40	.29	.29	.29	.29	.29	.31	.29	.29	.29	.29	.34	.29	.29	.28	.25	.26
New Brunswick	.25	.25	.55	.36	.24	.25	.25	.25	.26	.28	.26	.27	.28	.28	.33	.28	.28	.28	.29	.29
New Hampshire	.23	.23	.53	.34	.23	.24	.24	.24	.25	.27	.26	.27	.27	.27	.32	.27	.27	.28	.29	.29
New Jersey	.22	.24	.54	.35	.25	.22	.22	.24	.25	.27	.26	.26	.26	.27	.31	.27	.27	.28	.29	.29
New Mexico	.28	.28	.58	.39	.28	.28	.28	.28	.28	.30	.28	.28	.28	.28	.33	.28	.28	.26	.28	.28
New York	.23	.24	.54	.35	.24	.24	.24	.24	.25	.27	.26	.26	.26	.27	.31	.27	.27	.28	.29	.29
New York City	.22	.23	.53	.33	.24	.23	.23	.23	.25	.27	.26	.26	.26	.27	.31	.27	.27	.28	.29	.29
North Carolina	.25	.26	.56	.37	.26	.25	.25	.25	.25	.27	.25	.25	.25	.25	.30	.25	.25	.26	.29	.29
North Dakota	.28	.28	.58	.39	.28	.28	.28	.28	.28	.30	.28	.28	.28	.28	.33	.28	.28	.28	.28	.28
Nova Scotia	.25	.25	.55	.36	.24	.25	.25	.25	.26	.28	.26	.27	.28	.27	.33	.28	.28	.28	.29	.29
Ohio	.24	.25	.55	.36	.25	.24	.24	.24	.25	.27	.26	.26	.26	.26	.31	.26	.26	.27	.29	.29
Oklahoma	.28	.28	.58	.39	.28	.28	.28	.28	.27	.29	.27	.27	.28	.28	.33	.26	.25	.25	.28	.28
Ontario	.25	.25	.55	.36	.25	.25	.25	.25	.26	.28	.27	.28	.28	.28	.33	.28	.28	.28	.29	.29
Oregon	.29	.29	.59	.40	.29	.29	.29	.29	.29	.31	.29	.29	.29	.29	.34	.29	.29	.28	.25	.25
Pennsylvania	.23	.24	.54	.35	.25	.24	.23	.24	.25	.27	.26	.26	.26	.26	.31	.26	.26	.28	.29	.29
Philadelphia	.23	.24	.54	.35	.25	.22	.22	.22	.25	.27	.26	.26	.26	.26	.31	.26	.26	.28	.29	.25
Quebec	.25	.25	.55	.36	.24	.25	.25	.25	.26	.28	.27	.28	.28	.27	.33	.28	.28	.28	.29	.29
Rhode Island	.23	.22	.52	.33	.24	.24	.24	.24	.25	.27	.26	.26	.26	.27	.31	.27	.27	.28	.29	.29
South Carolina	.26	.26	.56	.37	.26	.26	.25	.25	.25	.27	.22	.25	.25	.25	.30	.25	.25	.26	.29	.29
South Dakota	.28	.28	.58	.30	.28	.28	.28	.28	.28	.30	.28	.28	.28	.28	.33	.28	.28	.27	.28	.28
Tennessee	.25	.26	.56	.37	.26	.25	.25	.25	.25	.27	.25	.25	.25	.25	.30	.26	.25	.26	.29	.29
Texas	.28	.28	.58	.39	.28	.28	.28	.28	.28	.30	.26	.26	.26	.27	.31	.26	.25	.23	.28	.28
Utah	.28	.28	.58	.39	.28	.28	.28	.28	.28	.30	.28	.28	.28	.28	.23	.28	.28	.28	.26	.27
Vermont	.23	.23	.53	.34	.23	.24	.24	.24	.25	.27	.26	.27	.27	.27	.32	.27	.27	.28	.29	.29
Virginia	.24	.25	.55	.36	.25	.25	.25	.24	.22	.24	.25	.25	.25	.25	.30	.25	.26	.27	.29	.29
Washington	.29	.29	.59	.40	.29	.29	.29	.29	.29	.31	.29	.29	.29	.29	.34	.29	.29	.28	.26	.23
West Virginia	.24	.25	.55	.36	.25	.24	.24	.24	.24	.26	.25	.25	.26	.26	.31	.26	.26	.28	.29	.29
Wisconsin	.26	.26	.56	.37	.27	.26	.26	.26	.26	.28	.26	.27	.27	.27	.32	.27	.27	.27	.28	.28
Wyoming	.28	.28	.58	.39	.28	.28	.28	.28	.28	.30	.28	.28	.28	.28	.33	.28	.28	.27	.28	.28

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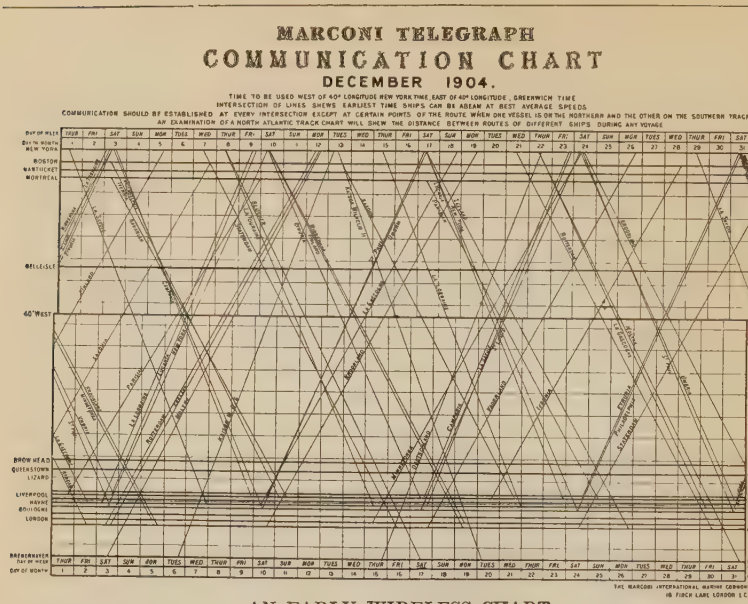
* The principal transatlantic liners are equipped with special long distance receiving apparatus and can be communicated with from the High Power Station at South Wellfleet, Mass., when 60 hours from New York. The rate for this service is 30 cents per word *additional* to the rate via the short distance station at South Wellfleet, and is so noted in the table.

WIRELESS INFORMATION.

Travelers by the principal passenger vessels have at their disposal when at sea a Public Telegraph Service in the Marconi Wireless Telegraph System, working in conjunction with the ordinary Inland Telegraphs and the International Cables throughout the World. Telegrams are accepted on board ship for transmission to all parts of the world through such Marconi Telegraph stations as the vessel may pass. Telegrams are also accepted for passing ships fitted with Marconi Telegraphs, either for delivery on board or for re-transmission through shore stations. Ordinary Marconigrams for transmission to ships at sea may be handed in at any of the offices of the telegraph companies. Telegrams should be addressed in the following manner: "John Brown, Steamer Mauretania, via South Wellfleet, Mass." All wireless messages must be prepaid. Should the wireless station via which the message is first routed fail to reach the steamer addressed, the fact will be reported to the originating office, so that, if the sender orders, the message may be sent to another station. When this is done, tolls must be computed via the new route, and any necessary additional tolls collected. In case the Wireless Co. fails to reach a steamer and the sender does not order it forwarded, the "other" line or "wireless" toll may be refunded.


MARCONI TELEGRAPH
COMMUNICATION CHART
DECEMBER 1904.
TIME TO BE USED WEST OF 40° LONGITUDE NEW YORK TIME, EAST OF 40° LONGITUDE GREENWICH TIME
INTERSECTION OF LINES SHEWS EARLIEST TIME SHIPS CAN BE ABEAM AT BEST AVERAGE SPEEDS
COMMUNICATION SHOULD BE ESTABLISHED AT EVERY INTERSECTION EXCEPT AT CERTAIN POINTS OF THE ROUTE WHEN ONE VESSEL IS ON THE NORTHERN AND THE OTHER ON THE SOUTHERN TRACK
AN EXAMINATION OF A NORTH ATLANTIC TRACK CHART WILL SHEW THE DISTANCE BETWEEN ROUTES OF DIFFERENT SHIPS DURING ANY VOYAGE
40° WEST
THE MARCONI INTERNATIONAL MARINE COMMUNICATION Co LTD
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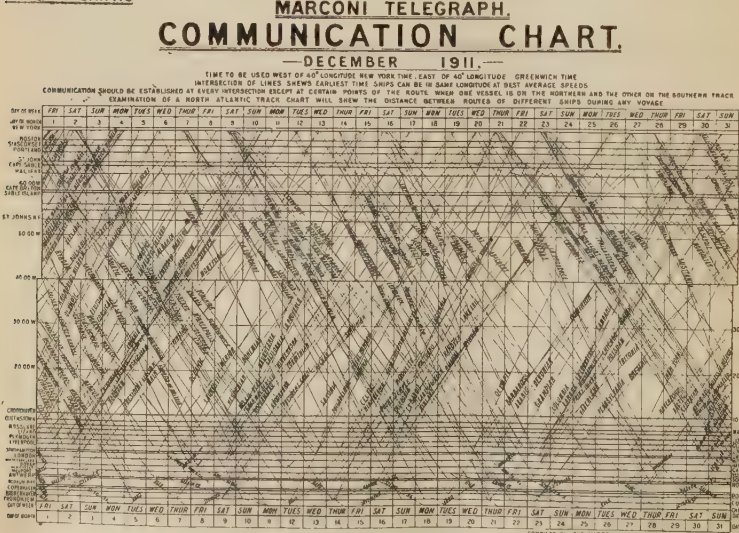
AN EARLY WIRELESS CHART

NORTH ATLANTIC


MARCONI TELEGRAPH.
COMMUNICATION CHART.
—DECEMBER 1911.—
TIME TO BE USED WEST OF 40° LONGITUDE NEW YORK TIME, EAST OF 40° LONGITUDE GREENWICH TIME
INTERSECTION OF LINES SHEWS EARLIEST TIME SHIPS CAN BE IN SAME LONGITUDE AT BEST AVERAGE SPEEDS
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EXAMINATION OF A NORTH ATLANTIC TRACK CHART WILL SHEW THE DISTANCE BETWEEN ROUTES OF DIFFERENT SHIPS DURING ANY VOYAGE
COMPILED BY THE MARCONI INTERNATIONAL MARINE COMMUNICATION Co LTD
WATERGATE HOUSE, YORK BUILDINGS
ADELPHI, LONDON W C

SEVEN YEARS LATER THE INTERLACING LINES SHOW POSSIBLE INTERCOMMUNICATIONS WHICH HAVE ROBBED THE SEA OF MANY OF ITS TERRORS.

PHENOMENAL INCREASE IN WIRELESS ACTIVITY.

CHAPTER XI.

TELEPHONE STATISTICS OF THE WORLD.

There were approximately 12,453,000 telephones and 29,566,000 miles of telephone wire in use in the world January 1, 1912. A careful estimate places the world's telephone investment January 1, 1912, at about $1,729,000,000 which is very nearly the value of all gold coin and bullion in the United States. The annual number of telephone conversations may be placed at 22,000,000,000, which is about five times the annual number of passengers carried by all the railroads of the world.

For the purpose of this compilation the world's telephone statistics are generally tabulated in four territorial divisions, as follows:

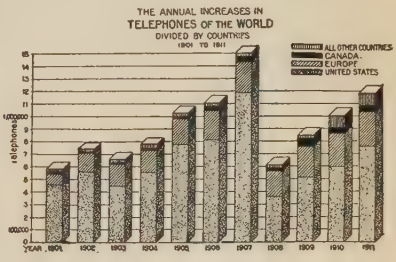
	Telephones Jan. 1, 1912			Wire Jan. 1, 1912		
	Number (partly estimated)	Increase over Jan. 1, 1911	Per cent to Total	Miles (partly estimated)	Increase over Jan. 1, 1911	Per cent to Total
United States	8,362,000	10%	67 1%	18,179,000	9%	61.5%
Canada	335,000	18%	2 7%	788,000	11%	2.6%
Europe	3,239,000	9%	26.0%	9,461,000	8%	32.0%
All other countries	517,000	21%	4.2%	1,138,000	32%	3.9%
Total	12,453,000	10%	100.0%	29,566,000	9%	100.0%

The geographical distribution of telephones and wire is shown below:

	Number of Telephones (Partly Estimated)			Miles of Wire (Partly Estimated)		
	Jan. 1, 1912	Jan. 1, 1911	Increase	Jan. 1, 1912	Jan. 1, 1911	Increase
North America	8,729,000	7,907,000	822,000	19,037,000	17,401,000	1,636,000
South America	120,000	86,000	34,000	233,000	137,000	96,000
Europe	3,239,000	2,966,000	273,000	9,461,000	8,762,000	699,000
Asia	166,000	149,000	17,000	358,000	288,000	70,000
Africa	41,000	34,000	7,000	144,000	128,000	16,000
Australasia	124,000	110,000	14,000	265,000	212,000	53,000
Oceanica	17,000	8,000	9,000	40,000	15,000	28,000
West Indies	17,000	12,000	5,000	25,000	19,000	6,000
Total	12,453,000	11,272,000	1,181,000	29,566,000	26,962,000	2,604,000

The year 1911 is the thirty-fifth since the invention of the telephone by Prof. Alexander Graham Bell. A survey of the progress of telephone service during the past year, and of the many notable events in connection with this progress, justifies the statement that all civilized nations have awakened to the value of the telephone in commercial and social life.

In the United States commercial service has been opened between New York and Denver, 2,160 miles, this being now the longest distance over which oral communication is given commercially. In Europe long distance service has been greatly extended by utilizing both the new loaded cable between Great Britain and Belgium—by which telephone service is expected to be given between London and Berlin—and the new telephone cable, constructed also on the Pupin principle, between Dover and Calais. The latter enables conversation to be carried on between Glasgow, Edinburgh and Paris, and also between Aberdeen and the French capital, a distance of 910 miles. Successful trials have also been made between London and Geneva, a distance of 560 miles, and from London to Bâle, a distance of 600 miles.



Recent progress in the art of submarine telephone cable manufacture will have far reaching consequences. At the present time there are over 400 miles of submarine telephone cable in use in the world, and of this total about one-half is represented by the four cables between France and England, and the two between Belgium and England. The longest submarine telephone cable lies between La Panne (Belgium) and St. Margaret's Bay (England), a distance of 55 miles.

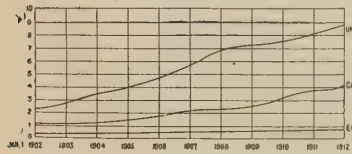
The European international long distance land line systems have likewise received important additions, due to the opening of the line between Paris and Madrid, 900 miles, and the direct line between Berlin and Rome still under construction, a distance of over 1,000 miles. As regards the Continent, there is now scarcely any important city that cannot talk with any other important city. By far the largest interurban or toll telephone plant in Europe has been built by the German Government, which according to the latest official statistics, had about one-half of the total interurban or toll telephone wire of Europe.

Finally, it is worthy of note that during the year 1911 the great United States railway systems have made rapid advances toward the general use of the telephone for train dispatching. Since the introduction of the use of the telephone for that purpose, over 200 of the United States railroads have adopted that system. In fact, the telephone has supplanted the telegraph on over 50,000 miles of railroad, which is over 20% of the total railroad mileage of the country. A careful estimate places the miles of wire used by railroad companies for train dispatching at 120,000, and the corresponding number of telephones at 10,000.

Considering telephones per 100 population and referring only to the United States, Canada and Europe, the following chart shows their respective condition during the past ten years. At the beginning and end of the period the exact figures are:

	United States	Canada	Europe
Jan. 1, 1902.....	2.3	1.2	0.3
Jan. 1, 1912.....	8.8	4.2	0.7

From this it appears that it takes Europe about two years to advance 0.1. Assuming that European telephone progress continues at this rate, to reach the present development of the United States (8.8), Europe must gain 8.1, which at the rate of 0.1 every two years would require 162 years. As such a forecast makes no allowance for the impetus in future progress due to the use of rates better adapted to the needs of the public and important advances in the art, the above period will be shortened materially. One thing, however, is certain: Europe offers yet a vast field for telephone progress, because at the beginning of 1912 it has reached only the development of the United States Jan. 1, 1898.



TELEPHONES PER 100 POPULATION UNITED STATES, CANADA AND EUROPE, 1902 TO 1912.

It is worthy of note that the United States, Jan. 1, 1912, had over one-half the total telephone wire of the world, and nearly twice the total mileage of Europe, while the latter at the same date had almost the same telephone wire mileage as the United States had at Jan. 1, 1907. The pronounced increase in the wire mileage of "all other countries" is largely due to more accurate information.

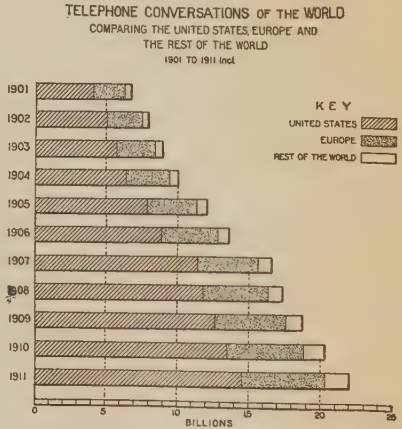
The combined number of telephone conversations of the rest of the world is but one-half that of the United States. The telegraph traffic of the United States presents quite a contrast. Placing the world's telegraph traffic during 1910 at about 579,000,000, the United States took but 17% of the total, while Europe had 62%. In other words, Europe has about the same proportion of the world's telegraph traffic as the United States has of the world's telephone traffic.

Going back to the first authentic publication of telephone traffic in the United States (1883) the total number of telephone conversations was estimated to be 217,000,000. During the intervening twenty-eight years the United States traffic has reached, as shown above, the colossal total of over fourteen billion, an increase of 6500%, or an average annual increase of 232%.

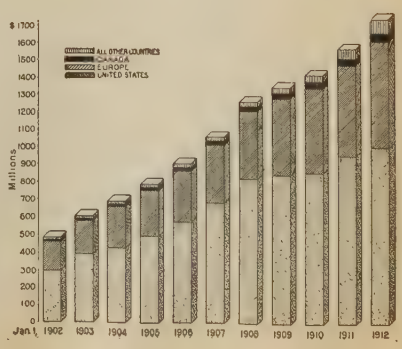
The annual increases, both in the telephone and telegraph traffic and in the wire plant of the world are shown on the chart on page 315, covering the period 1900-1910. The curves represent the percentage increases over the traffic during 1900 and mileages at the end of the year 1900.

Referring first to the traffic curves, the telephone has gained 277% and the telegraph 36%. In other words, the percentage increase in telephone traffic is about eight times that in telegraph traffic. During the same period the increase in wire plant was 448% for the telephone as compared with 57% for the telegraph, so that the percentage increase in telephone wire is also approximately eight times that of telegraph wire.

The following chart depicts the telephone conversations of the world for the years 1901 to 1911 inclusive, for the United States, Europe, and all other countries, and shows the proportion of each to the total.

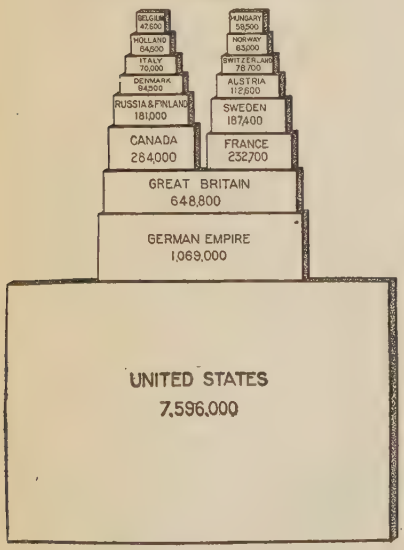


The chart annexed depicts the total estimated telephone investment of the world, subdivided according to territorial divisions at Jan. 1st of each year from 1902 to 1912 inclusive. During this period the world's invest-



ment almost quadrupled, increasing from $482,000,000 to $1,729,000,000. Over one-half of this enormous increase was in the United States, where the annual increase averaged approximately $66,000,000. This was about $27,000,000 more than the corresponding average increase in Europe. At the commencement of the year 1912 the total estimated investment in the United States ($1,025,000,000) was about twice that in all Europe ($593,000,000) and was over one-half the investment of the whole world. At the same date Canada is estimated to have $44,000,000 invested in telephones and "all other countries" $67,000,000.

Relative Telephone Development in Various Countries, Jan. 1, 1911.



Telephones in Use.

The statistical table shows the telephone development of the world January 1, 1911. At that date the United States had 67.4% of the total telephones, Europe had 26.3%, Canada 2.5%, thus leaving but 3.8% for all other countries. The high percentage increase during 1910 for Bosnia, Greece and Servia, is due to the fact that these countries are just beginning to be developed.

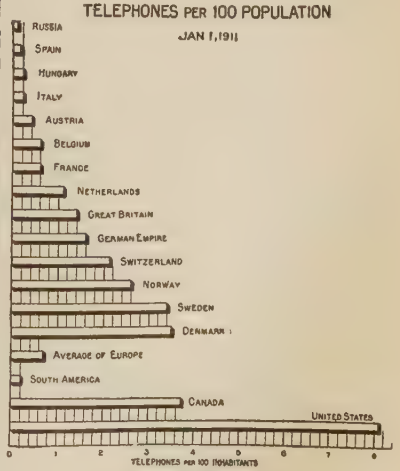
The table shows, that, as in former years, the German Empire and Great Britain remain the leaders in European telephone development, the German Empire having about 36% and Great Britain 22% of all European telephones. Of the remaining countries, only one, France, exceeds 200,000 telephones, and only three others—Austria, Russia and Sweden—

TELEPHONE DEVELOPMENT OF THE WORLD, JANUARY 1, 1911

Division.	Telephones January 1, 1911.	Increase during 1910		Per cent of Total	Telephones per 100 Population	Population per Sq Mile
		Number	%			
United States	7,595,938	600,246	8.6	67.4	8.1	30
Canada	284,373	45,184	18.8	2.5	3.7	4.7
Europe —						
Austria	112,604	16,764	17.5	1.0	0.4	246
Belgium	47,648	4,907	11.5	0.4	0.6	663
Bosnia	747	151	25.3	.	0.04	96
Bulgaria	2,303	253	12.3	.	0.05	116
Denmark	94,321	7,095	8.1	0.9	3.5	182
Finland	30,478	.	.	0.3	1.0	21
France	232,743	21,079	9.9	2.0	0.6	190
German Empire	1,068,869	100,748	10.4	9.5	1.6	310
Great Britain	648,832	45,235	7.5	5.8	1.4	371
Greece	1,792	290	19.3	.	0.06	107
Hungary	58,506	7,481	14.6	0.5	0.2	167
Italy	70,139	7,873	12.6	0.6	0.2	312
Luxemburg	3,334	220	7.0	.	1.3	237
Netherlands	64,620	6,207	10.6	0.6	1.1	464
Norway	63,000	5,647	9.8	0.6	2.6	19
Portugal	6,765	451	7.1	.	0.1	155
Roumania	15,000	812	5.7	0.1	0.2	137
Russia	150,850	20,377	15.6	1.3	0.1	67
Servia	2,635	1,075	68.9	.	0.1	155
Spain	25,000	196	0.8	0.2	0.13	99
Sweden	187,441	13,386	7.7	1.6	3.4	32
Switzerland	78,736	4,978	6.7	0.7	2.1	236
Total	2,966,553	265,225	9.8	26.3	0.7	119
South America	85,744	13,642	18.9	0.8	0.2	6.5
All other countries	339,285	92,671	37.6	3.0	0.03	28
Total World	11,271,893	1,016,968	9.9	100.0	0.6	30

have over 100,000 telephones each. The combined number of telephones in six important European States—Belgium, Norway, Denmark, Hungary, Italy, and the Netherlands—is still less than the number of telephones in New York City, while Chicago has more telephones than France, and Boston more than Austria; the three Scandinavian kingdoms combined do not equal the total number of telephones in New York City by about 57,000.

The following chart presents graphically the statistics shown in the above table in the column "Telephones per 100 Population." Despite considerable activity in some European



countries, the relative positions have not changed during the past year. Denmark still leads Sweden by a small margin. As the average for Europe January 1, 1911, was 0.7 telephones per 100 population, the development of the United States at the same date—8.1 per

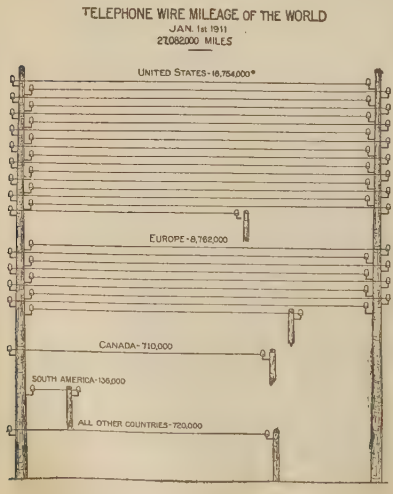
100 population—was almost twelve times that of Europe. South America advanced to 0.2 telephones per 100, and Canada to 3.7, or more than five times the development of Europe.

Looking at the telephone development from the point of population per station, it appears that the United States January 1, 1911, averaged one station to each 12 inhabitants, as against the European average of one to 148. Of the European States, Denmark and Sweden are about equal, the former having one station to every 28, and the latter one station to every 29 inhabitants. The German Empire and Great Britain have about twice, France six times and Austria eight times the population per station of Sweden.

In actual number of telephones, Jan. 1, 1911 Berlin, London and Paris, with a combined total of 403,500 telephones, are about even with New York (402,000). The latter approximates very nearly the combined telephones of 14 European States.

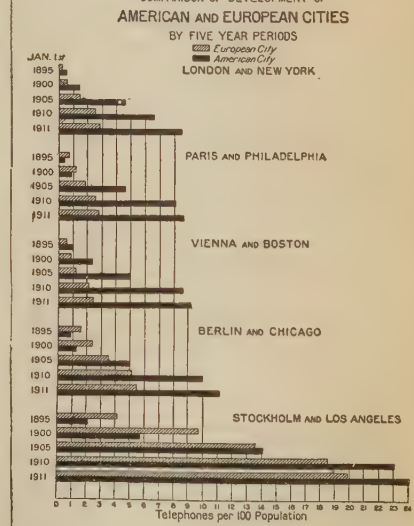
Wire Mileage.

The next statistical table and chart view the telephone development of the world in point of wire plant January 1, 1911. At date the grand total of telephone wire mileage was about 27,000,000, of which the United States possessed 61.7%, Europe 32.5%, Canada 2.6%, South America 0.5% and all other countries 2.7%. Thus the United States has almost twice the total telephone wire of all Europe. The German Empire, though possessing the largest number of telephones of any of the European States, has but one-fifth the telephone wire of the United States, and Great Britain but one-eighth.



MILES OF TELEPHONE WIRE

Division	Miles of Wire Jan. 1, 1911	Increase during 1910		Per cent of Total Jan. 1, 1911
		Miles	%	
United States	16,633,590	1,383 141	9 0%	61 7
Canada	709,708	102,960	16 9	2.6
Europe:—				
Austria	287,523	31,179	12 1	1 0
Belgium	147,252	9,076	6 5	0 6
Bosnia	1,403	95	7 2	
Bulgaria	5,762	523	10 0	..
Denmark	254,989	29,837	13.2	0 9
Finland	76,793	6,982	10 0	0 3
France	831,169	93,527	12 7	3 0
German Empire	3,553,504	329,027	10.2	13 2
Great Britain	2,116,368	91,420	4 5	7 9
Greece	5,353	1,064	24 0	
Hungary	201,636	22,604	12 6	0 8
Italy	161,628	14,693	10 0	0 6
Luxemboorg	3,612	62	1 7	
Netherlands	141,478	19,082	15 6	0 5
Norway	129,168	8,383	6 9	0 5
Portugal	21,114	1,858	9 6	
Roumania	45,333	4,175	10 0	
Russia	260,049	18,630	7 7	1 0
Servia	8,045	678	9 2	
Spain	54,027	4,806	9 8	..
Sweden	245,737	23,108	10 4	0 9
Switzerland	210,032	9,192	4.5	0 8
Total	8,761,965	719,999	8.9	32 5
South America	136,676			0 5
All other countries	720,168			2 7
Total World	26,962,107	2,384,653	9 7	100.0



The table on the opposite page shows the estimated total length of telephone and telegraph wires January 1, 1911, including railroad telephone and telegraph wire.

The statistics place the total length of telephone and telegraph wires in the world January 1, 1911, at 34,500,000 miles. Of this total, telephone wire took 78%, telegraph wire (including cables) 17%, and railroad telegraph wire 5%. Again, the United States took 62% of the total telephone wire, and 34% of the total telegraph wire (excluding cables and railroad telegraph wire).

Length of World's Telephone and Telegraph Wire.

(Partly Estimated)

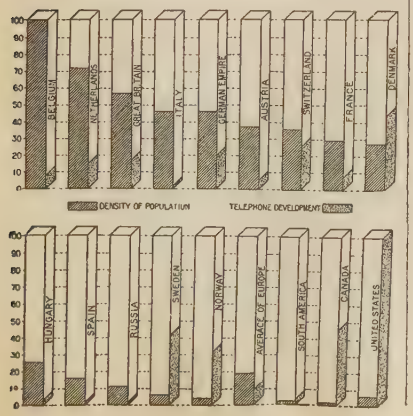
JANUARY 1, 1911.

	Miles	
TELEPHONE WIRE:		
United States	16,634,000	
Canada	709,000	
Europe	8,762,000	
All other Countries	857,000	
	26,962,000	
U. S. RAILROAD TELEPHONE WIRE	120,000	
Total Telephone Wire		27,082,000
TELEGRAPH WIRE:		
United States	1,849,000	
Canada	153,000	
Europe	2,352,000	
All other Countries	1,090,000	
	5,444,000	
SUBMARINE TELEGRAPH WIRE (in cables)	314,000	
RAILROAD TELEGRAPH WIRE	1,726,000	
Total Telegraph Wire		7,484,000
Grand Total		34,566,000

A more comprehensive view of the relation between telephone development and population is gained from the following chart. This chart compares European countries, the United States and Canada, representing in each case both population per square mile and telephones per 100 population. The greatest population per square mile is found in Belgium, which has 663 inhabitants to the square mile, and the largest number of telephones per 100 population is found in the United States, which January 1, 1911, had 8.1 telephones per 100 population.

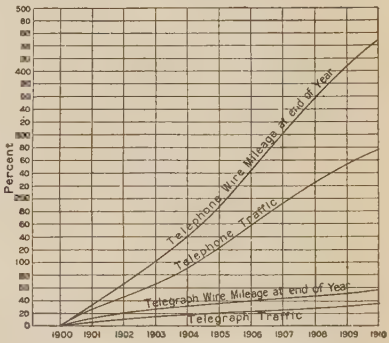
COMPARISON OF
DENSITY OF POPULATION
AND
TELEPHONE DEVELOPMENT
JAN 1, 1911

NOTE: Density of population in Belgium and telephone development (telephones per 100 population) in the United States taken as 100%.



It is evident from the chart that Canada has by far the lowest density of population; next comes South America and then Norway, while Sweden is about equal to the United States, and Italy to Germany. In telephone development Canada ranks next to the United States. Denmark and Sweden, which have about the same development, are still considerably below one-half the telephone development of the United States.

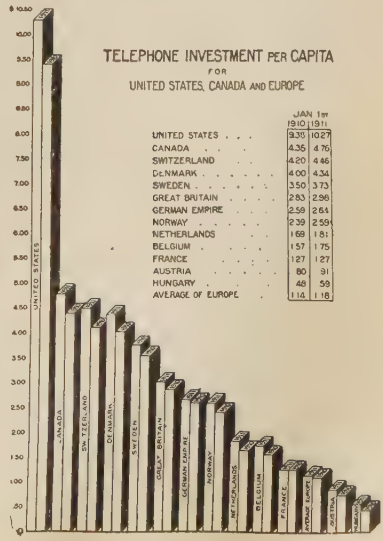
THE GROWTH OF
TELEPHONE AND TELEGRAPH TRAFFIC
AND WIRE MILEAGE COMPARED
THE WORLD

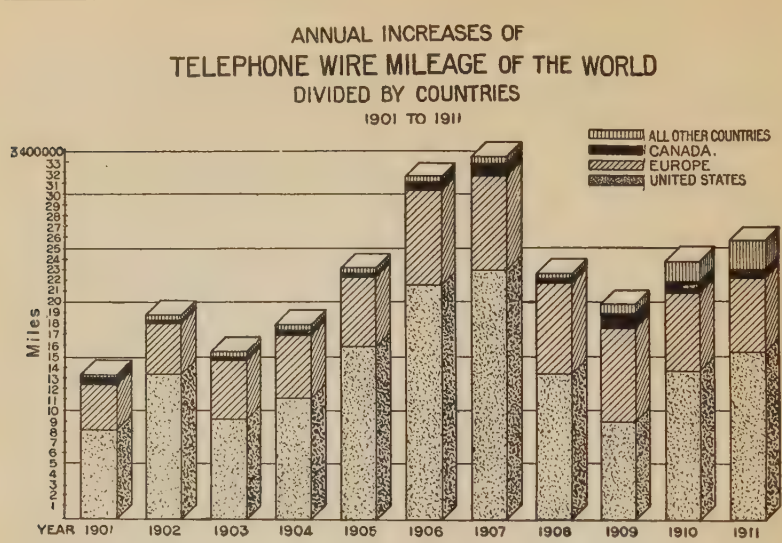


Note: Growth expressed as a percentage increase over the 1900 figures.

TELEPHONE INVESTMENT PER CAPITA
FOR
UNITED STATES, CANADA AND EUROPE

	JAN 1ST 1910	1911
UNITED STATES	9.30	10.27
CANADA	4.36	4.76
SWITZERLAND	4.20	4.46
DENMARK	4.00	4.34
SWEDEN	3.50	3.73
GREAT BRITAIN	2.83	2.96
GERMAN EMPIRE	2.59	2.64
NORWAY	2.39	2.59
NETHERLANDS	1.69	1.81
BELGIUM	1.57	1.75
FRANCE	1.27	1.27
AUSTRIA	.80	.91
HUNGARY	.48	.59
AVERAGE OF EUROPE	1.14	1.18





Telephone Investment.

The statistics referring to investment do not always represent the actual replacement values of the various telephone plants, as such information is not recorded by the majority of foreign telephone administrations. The only data available in many cases are the aggregate amounts that have been put into the business since its inception. The world's telephone investment January 1, 1911, is estimated at $1,561,800,000, equivalent to $139 per telephone. This total investment is thus approximately equal to the value of the corn crop of the United States in 1911.

Of this total investment of $1,561,800,000, the United States invested $956,700,000, or 61.2 per cent. of the total; Canada $36,700,000, or 2.4 per cent. of the total; Europe $518,400,000, or 33.2 per cent. of the total; and all other countries $50,000,000, or 3.2 per cent. of the total.

Figured on the respective number of telephones on Jan. 1, 1911, the investment per telephone is:

United States	$126
Canada	129
Europe	175
All other countries	118
Total world	139

The investment representing "all other countries" includes $16,456,000 for the Commonwealth of Australia and New Zealand, $4,795,000 for the Union of South Africa, $15,223,000 for Japan, and about $6,668,000 for Brazil and Chili together.

During the year 1910, $145,500,000 was added to the telephone investment of the world, so that the above total of $1,560,800,000 represents an increase of 10% over the corresponding investment Jan. 1, 1911. In the United States alone, the estimated increase in investment during 1910 amounted to $97,600,000, or, excluding Europe, considerably more than the total cost of all telephone plants in service in the entire world.

In regard to the more detailed investment statistics given on the following page, perhaps the most striking feature of the table is the high figure for investment per telephone in many of the important European States. For instance, Austria, Belgium, France, Great Britain, Hungary, Spain, and Switzerland all show an investment per telephone of over $200.

The German Empire, Great Britain, and France combined have slightly more than two-thirds the entire telephone investment of Europe.

Excepting the German Empire and Great Britain, none of the European States exceeds $100,000,000, and the majority have invested less than $20,000,000 apiece. Of the Scandinavian kingdoms, Sweden has approximately twice the investment of Denmark, which in turn has about twice that of Norway.

Viewing telephone investment from a per capita basis, a very different situation is revealed. A glance at the chart on page 315 shows that of the European countries Switzerland leads, and Denmark has advanced to second position; on the other hand, though the German Empire occupied first rank in point of total investment, it takes fifth place in point of investment per capita. The per capita investment of the United States ($10.27) is about nine times that of Europe ($1.18). Of the European countries shown on the chart, Hungary has the lowest per capita investment ($0.59), and Austria has not yet reached an investment of $1.00 per capita.

Investment—Telephone and Telegraph.

It is interesting to compare the telephone investment of the world with that of the telegraph (including submarine cables). In the absence of any definite information covering the entire world on that subject, only an estimate can be made. Using the total telegraph wire mileage, January 1, 1911, as a basis, the telegraph investment may be estimated at about $700,000,000. There are also 314,000 miles of submarine cables representing an estimated investment of $350,000,000, so that the total telegraph investment of the world January 1, 1911, may be placed at $1,050,000,000, as compared with a telephone investment of $1,561,777,000 at the same date.

This makes a total investment of $2,619,497,000 for telephone and telegraph (including submarine cables) for the world, January 1, 1911. Of this total 60 per cent. is invested in telephones, 27 per cent. in telegraphs and 13 per cent. in cables.

TELEPHONE GROSS EARNINGS OF THE UNITED STATES, CANADA, EUROPE AND ALL OTHER COUNTRIES
(Partly Estimated)
YEAR 1909

Division	Gross Earnings	% to Total Earnings	Increase During 1909	Avg. Earnings per Telephone
United States	$221,471,000	67.4%	$20,881,000	$32.87
Canada	6,752,032	2.0	1,161,000	31.87
Europe—				
Austria	3,704,990	1.1	584,000	41.45
Belgium	2,066,740	0.6	152,000	50.75
Bosnia	11,555	..	1,900	21.90
Bulgaria	65,135	..	7,000	21.65
Denmark	2,040,158	0.6	233,000	24.45
Finland	448,518	..	..	13.95
France	8,161,600	2.4	1,098,000	40.20
German Empire	32,330,909	9.8	3,407,000	35.00
Great Britain	23,113,326	7.0	1,858,000	39.40
Greece	37,048	..	4,000	26.40
Hungary	1,859,205	0.6	155,000	38.85
Italy	2,416,902	0.8	348,000	42.70
Luxembourg	62,697	..	6,000	20.80
Netherlands	1,731,700	0.5	244,000	32.45
Norway	1,159,864	0.3	40,000	21.35
Portugal	240,516	..	10,000	40.00
Roumania	277,947	..	35,000	22.30
Russia	4,756,475	1.4	469,700	39.00
Servia	58,575	..	4,000	37.65
Spain	831,125	..	38,000	35.20
Sweden	3,959,765	1.2	309,000	23.60
Switzerland	1,996,439	0.6	169,000	27.95
Total	91,331,189	27.8	9,172,600	35.40
All other countries	9,163,500	2.8		30.00
Total world	$328,717,721	100.0%		

COMPARISON OF THE GROSS TELEPHONE AND TELEGRAPH EARNINGS OF EUROPEAN COUNTRIES FOR 1909.

Country	Gross Telephone Earnings	Gross Telegraph Earnings	Total Earnings	Per cent of Total Gross Earnings	
				Telephone	Telegraph
Austria	$3,704,990	$3,162,571	$6,867,561	54%	46%
Belgium	2,066,740	1,191,450	3,258,190	63%	37%
Bosnia	11,555	281,324	292,879	4%	96%
Bulgaria	65,135	294,610	359,745	18%	82%
Denmark	2,040,158	488,697	2,528,855	81%	19%
France	8,161,600	8,101,828	16,263,428	50%	50%
German Empire	32,330,909	8,771,920	41,102,829	79%	21%
Great Britain	23,113,326	15,960,869	39,074,195	59%	41%
Greece	37,048	346,794	383,842	10%	90%
Hungary	1,859,205	1,491,079	3,350,284	55%	45%
Italy	2,416,902	3,820,513	6,237,415	39%	61%
Luxembourg	62,697	16,338	79,035	79%	21%
Netherlands	1,731,700	1,011,475	2,743,175	63%	37%
Norway	1,159,864	642,875	1,802,739	64%	36%
Portugal	240,516	849,862	1,090,378	22%	78%
Roumania	277,947	595,106	873,053	32%	68%
Russia and Finland	5,204,993	12,408,158	17,613,151	30%	70%
Servia	58,575	120,823	179,398	33%	67%
Spain	831,125	2,032,422	2,863,547	29%	71%
Sweden	3,959,765	615,049	4,574,814	86%	14%
Switzerland	1,996,439	812,661	2,809,100	71%	29%
Total Europe	$91,331,189	$63,016,424	$154,347,613	59%	41%

Earnings for 1909—Telephone and Telegraph.

The figures for gross telephone earnings in European countries are official, but those quoted for "all other countries" are mostly estimated. The total gross telephone earnings of the world for the year 1909 may be placed at $329,000,000, of which the United States earned $221,471,000 (67.4%), Canada $6,752,000 (2%), Europe $91,331,000 (27.8%), and all other countries $9,163,500 (2.8%).

The adjoined table shows the gross telephone earnings of the various European countries, ranging from $241,000 (Portugal) to $32,331,000 (German Empire). The average earnings per telephone for total Europe was $35.40.

On account of the almost universal custom af European governments of conducting the telephone as a branch of the postal and telegraph services, practically no European government keeps its accounts in such a manner as to reveal the true net financial result of its telephone service.

Traffic—Mail, Telegraph and Telephone.

Instructive as it would be to compare the traffic of the other two branches of transmission of intelligence—the mail and the telegraph—with the telephone traffic of the world, such a comparison would only be speculative on account of the lack of statistical material. There is, however, sufficient statistical information to permit a comparison of the traffic of these three services, both in the United States and in Europe, during the year 1909. The result is as follows:

Out of a total of 20,669,000,000 messages transmitted by the three services in Europe, 15,387,000,000 (74.4 per cent.) were by first class mail matter, 345,000,000 (1.7 per cent.) by telegrams and 4,937,000,000 (23.9 per cent.) by telephone. In the United States, out of a total of 21,508,000,000 messages, 8,793,000,000 (40.9 per cent.) were by first class mail matter, 98,000,000 (0.4 per cent.) by telegrams and 12,617,000,000 (58.7 per cent.) by telephone.

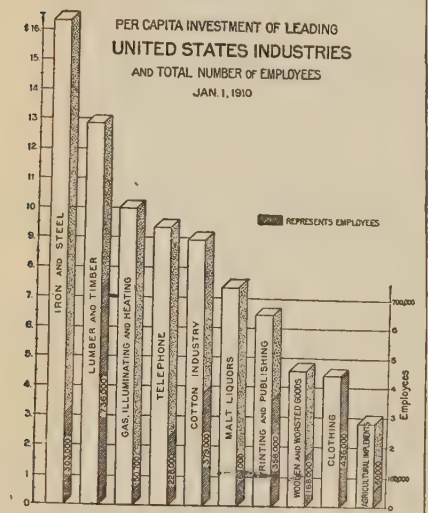
The figures show that although Europe has about three and a half times the telegraph traffic and nearly twice the first-class mail traffic, it has only one-third the telephone traffic of the United States.

The first class mail, telegraph and telephone traffic per 1,000 population for Europe and the United States during 1908 and 1909 was as follows:

For Europe; 35,533 pieces of first class mail matter in 1909, as against 34,766 in 1908, an increase of 2.2 per cent.; 798 telegrams in 1909, as against 769 in 1908, an increase of 3.7 per cent.; 11,400 telephone conversations in 1909, as against 10,585 in 1908, an increase of 7.7 per cent. For the United States: 96,090 pieces of first class mail matter in 1909, as against 90,062 in 1908, an increase of 6.7 per cent.; 1,076 telegrams in 1909, as against 1,039 in 1908, an increase of 3.5 per cent; 137,882 telephone conversations in 1909, as against 134,335 in 1908, an increase of 2.6 per cent.

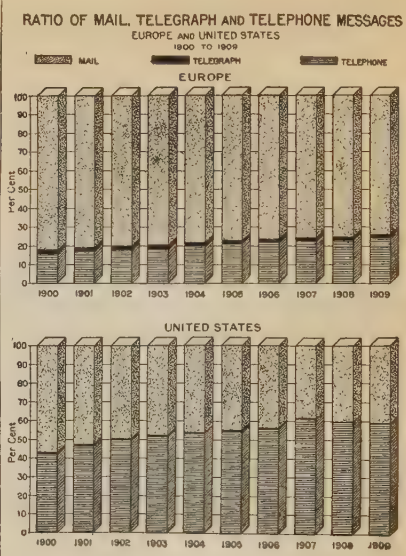
A Comparison With Other Industries.

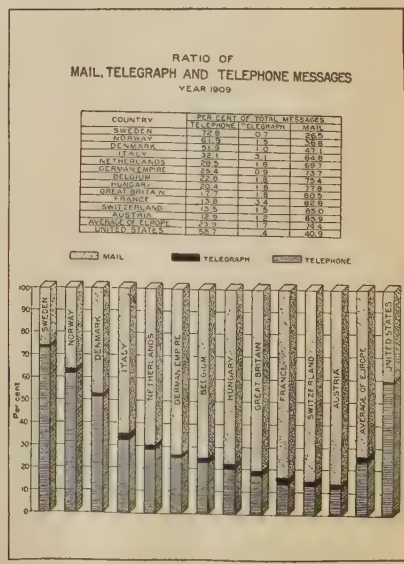
The magnitude of the United States telephone investment per capita may be emphasized by comparing the telephone with some of the other leading United States industries. Such a comparison is based on recent special reports by the United States Census Office, publishing the requisite data as of January 1, 1910. The chart shown below gives the result of a comparison of the telephone business with ten large United States industries. Despite the fact that the telephone has been in use but thirty-five years, the telephone investment per capita January 1, 1910 is the fourth largest, yielding only to the Iron and Steel, Lumber, and Gas and Heating industries.



The New York Telephone Company distributed 1,385,000 new telephone directories of the issue dated May 9, 1912. It required the service of 400 men working fifteen days to make the deliveries of this book, which comprises 804 pages. The number of subscribers listed is 280,000, not including the many thousands of branches in apartment houses, hotels and pay stations. The approximate cost of the telephone directory is $1,000 a day, or $365,000 annually. The first telephone directory was issued in 1878; at that time the total number of subscribers was 252.

One of the earliest experiments for reproducing sounds by means of sound boards connected by a rod was Wheatstone's "Magic Lyre," 1831. In 1861 Philip Reis conducted experiments to reproduce human speech by means of electric pulsation. In 1875 Prof. Bell invented the electric telephone, which he patented in 1876. Edison patented an invention of his July, 1877.





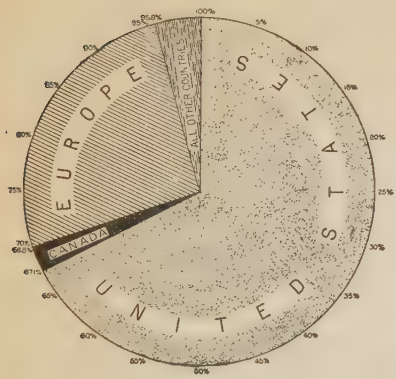
COUNTRY	PER CENT OF TOTAL MESSAGES		
	TELEPHONE	TELEGRAPH	MAIL
SWEDEN	72.6	0.7	26.5
NORWAY	61.3	1.3	37.4
DENMARK	51.8	1.0	47.2
ITALY	32.1	3.1	64.8
NETHERLANDS	30.5	1.6	69.7
GERMAN EMPIRE	25.4	0.9	73.7
BELGIUM	22.6	1.8	75.4
HUNGARY	22.5	1.6	75.9
GREAT BRITAIN	17.7	1.8	80.5
FRANCE	13.8	3.4	82.8
SWITZERLAND	13.5	1.5	85.0
AUSTRIA	12.9	1.6	85.5
AVERAGE OF EUROPE	20.3	1.7	78.4
UNITED STATES	54.7	.4	40.9

DISTRIBUTION OF THE WORLD'S TELEPHONES

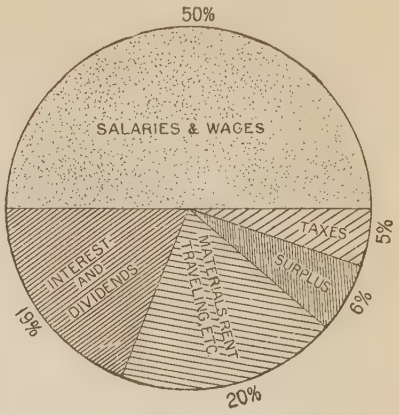
JANUARY 1, 1912.

12,453,000

(Partly Estimated)



DISPOSITION OF THE GROSS REVENUE OF THE BELL SYSTEM, YEAR 1911.



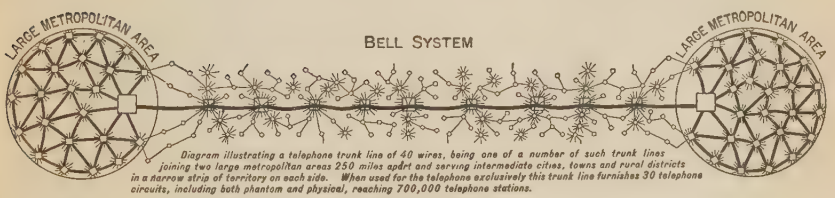


Diagram illustrating a telephone trunk line of 40 wires, being one of a number of such trunk lines joining two large metropolitan areas 250 miles apart and serving intermediate cities, towns and rural districts in a narrow strip of territory on each side. When used for the telephone exclusively this trunk line furnishes 30 telephone circuits, including both phantom and physical, reaching 700,000 telephone stations.

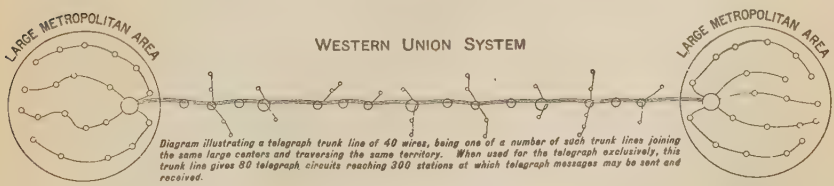


Diagram illustrating a telegraph trunk line of 40 wires, being one of a number of such trunk lines joining the same large centers and traversing the same territory. When used for the telegraph exclusively, this trunk line gives 80 telegraph circuits reaching 300 stations at which telegraph messages may be sent and received.

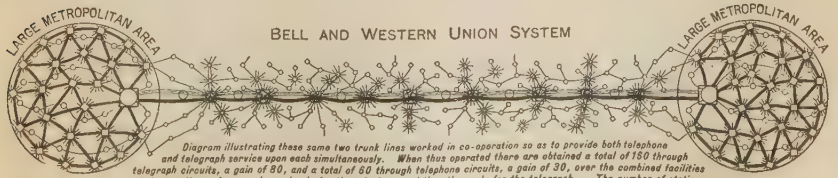


Diagram illustrating these same two trunk lines worked in co-operation so as to provide both telephone and telegraph service upon each simultaneously. When thus operated there are obtained a total of 150 through telegraph circuits, a gain of 80, and a total of 60 through telephone circuits, a gain of 30, over the combined facilities of the two lines when one is used only for the telephone and the other only for the telegraph. The number of stations where telegrams may be received and sent is increased from 300 to 700,000.

Telephone Central Office — a Telephone Toll Station

Telegraph Office

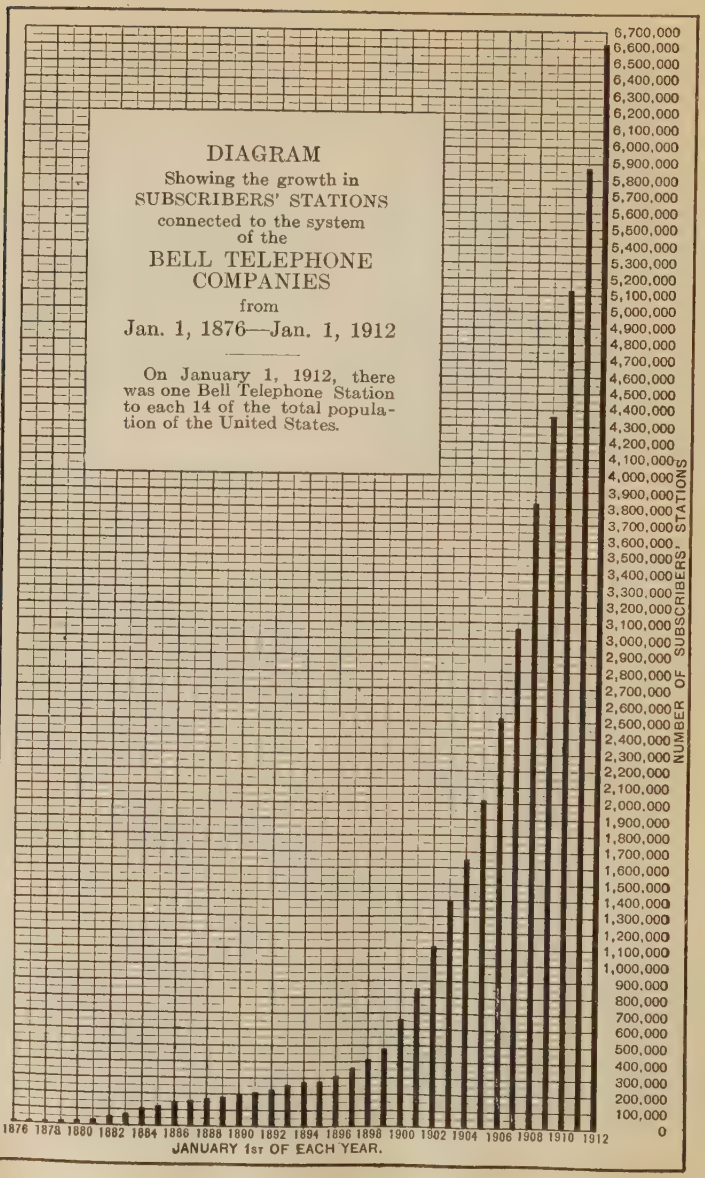


DIAGRAM
Showing the growth in
SUBSCRIBERS' STATIONS
connected to the system
of the
BELL TELEPHONE
COMPANIES
from
Jan. 1, 1876—Jan. 1, 1912
On January 1, 1912, there was one Bell Telephone Station to each 14 of the total population of the United States.
NUMBER OF SUBSCRIBERS' STATIONS
6,700,000
6,600,000
6,500,000
6,400,000
6,300,000
6,200,000
6,100,000
6,000,000
5,900,000
5,800,000
5,700,000
5,600,000
5,500,000
5,400,000
5,300,000
5,200,000
5,100,000
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700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
1876 1878 1880 1882 1884 1886 1888 1890 1892 1894 1896 1898 1900 1902 1904 1906 1908 1910 1912
JANUARY 1st OF EACH YEAR.

The growth of the Bell System, its broader usefulness and resulting prosperity, are shown in the annual report of the American Telephone and Telegraph Company for 1911 by the financial statement and other comparative statistics.

At the end of the year 1911 there was a total of 6,632,625 subscriber stations, of which 2,158,454 were operated by connecting companies.

The Bell toll lines now reach 70,000 places, which is 5,000 more than the number of post offices and 10,000 more than the number of railroad stations in the United States. The total wire mileage has been increased to nearly 13,000,000 miles, of which over half is underground, and the new 450-mile subway between Boston and Washington has been completed except for the drawing in of some of the cable.

The traffic over the Bell lines shows a daily average of 24,129,000, or at the rate of 7,770,000,000 connections a year.

There was spent in plant additions $55,660,738 in the year. There was applied to maintenance and reconstruction during the year $58,840,000, making a total provision for the last nine years of $342,300,000.

BELL TELEPHONE SYSTEM IN THE UNITED STATES.

CONDENSED STATISTICS.

	Dec. 31, 1895.	Dec. 31, 1900.	Dec. 31, 1905.	Dec. 31, 1910.	Dec. 31, 1911.	Increase, 1911.
Miles of Exchange Pole Lines	25,330	30,451	67,698	120,175	131,379	11,204
Miles of Toll Pole Lines	52,873	101,087	145,535	162,702	163,351	649
Total Miles of Pole Lines	78,203	131,538	213,233	282,877	294,730	11,853
Miles of Underground Wire	184,515	705,269	2,345,742	5,992,303	6,831,667	839,364
Miles of Submarine Wire	2,028	4,203	9,373	24,636	26,936	2,300
Miles of Aerial Wire	488,872	1,252,329	3,424,803	5,625,273	6,074,012	448,739
Total Miles of Wire	675,415	1,961,801	5,779,918	11,642,212	12,932,615	1,290,403
Comprising Toll Wire	215,687	607,599	1,265,236	1,963,994	2,060,514	96,520
Comprising Exchange Wire	459,728	1,354,202	4,514,682	9,678,218	10,872,101	1,193,883
Total	675,415	1,961,801	5,779,918	11,642,212	12,932,615	1,290,403
Total Exchange Circuits	237,837	508,262	1,135,449	2,082,960	2,306,360	223,400
Number of Central Offices	1,613	2,775	4,532	4,933	5,014	81
Number of Bell Stations	281,695	800,880	2,241,367	4,030,668	4,474,171	443,503
Number of Bell Connected Stations*	27,807	55,031	287,348	1,852,051	2,158,454	306,403
Total Stations	309,502	855,911	2,528,715	5,882,719	6,632,625	749,906
Number of Employees	14,517	37,067	89,661	120,311	128,439	8,128
Number of Connecting Companies, Lines and Systems				17,845	21,454	3,609
Exchange Connections Daily	2,351,420	5,668,986	13,543,468	21,681,471	23,483,770	1,802,299
Toll Connections Daily	51,123	148,528	368,083	602,539	644,918	42,379

*Includes Private Line Stations.

EARNINGS OF THE BELL SYSTEM OF THE UNITED STATES.

	1908	1909	1910	1911
Gross earnings	$138,144,300	$149,914,700	$165,612,881	$179,477,998
Expenses—operation	48,081,900	49,732,000	54,235,449	60,085,425
Maintenance and depreciation	39,736,700	44,838,900	52,028,009	59,840,354
Taxes	5,558,100	6,976,300	8,355,015	8,965,922
Total expenses	93,376,700	101,547,200	114,618,473	127,891,701
Net earnings	44,767,600	48,367,500	50,994,408	51,586,297
Deduct interest	10,874,100	10,221,400	11,556,864	13,610,860
Balance—net profits	33,893,500	38,146,100	39,437,544	37,975,437
Deduct dividends paid	20,719,000	23,910,600	25,160,786	25,966,876
Surplus earnings	13,174,500	14,235,500	14,276,758	12,008,561

PRINTERS' MARKS.

- ⊙ Period.
- , Comma.
- - Hyphen.
- : Colon.
- ; Semicolon.
- ' Apostrophe.
- " Quotations.
- □ Em quadrat.
- One-em dash.
- Two-em parallel dash.
- Push down space.
- Close up.
- Less space.
- Caret—left out, insert.
- Turn to proper position.
- # Insert space.
- ⊏ or ⊐ Move to left or to right.
- ⊓ or ⊔ Move up or move down.
- tr. Transpose.
- ----- or stat. Let it stand.
- Dele—take out.
- Broken letter.
- ¶ Paragraph.
- No ¶ No paragraph.
- w. f. Wrong font.
- eq. # Equalize spacing.
- caps. Capitals.
- s. c. Small capitals.
- l. c. Lower-case.
- Superior or inferior.
- or ital. Italic.
- rom. Roman.
- [ ] Brackets.
- ( ) Parentheses.

TYPOGRAPHICAL ERRORS.

It does not appear that the earliest printers had any method of correcting errors before the form was on the press. The learned ~~The learned~~ correctors of the first two centuries of printing were not proof-readers in our sense, they were rather what we should term office editors. Their labors were chiefly to see that the proof corresponded to the copy, but that the printed page was correct in its latinity, ~~that the words were there,~~ and that the sense was right. They cared ~~but~~ little about orthography, bad letters or purely printers' errors, and when the text seemed to them wrong they consulted fresh authorities or altered it on their own responsibility. Good proofs in the modern sense, were impossible until professional readers were employed men who had first a printer's education, and then spent many years in the correction of proof. The orthography of English, which for the past century has undergone little change, was very fluctuating until after the publication of Johnson's Dictionary, and capitals, which have been used with considerable regularity for the past 80 years, were previously used on the miss or hit plan. The approach to regularity, so far as we have, may be attributed to the growth of a class of professional proof readers, and it is to them that we owe the correctness of modern printing. More errors have been found in the Bible than in any other one work. For many generations it was frequently the case that Bibles were brought out stealthily, from fear of governmental interference. They were frequently printed from imperfect texts, and were often modified to meet the views of those who published them. The story is related that a certain woman in Germany, ~~who was~~ the wife of a printer, ~~and~~ had become disgusted with the continual assertions of the superiority of man over woman which she had heard, hurried into the composing room while her husband was at supper and altered a sentence in the Bible which he was printing, so that it read Narr instead of Herr, thus making the verse read "And he shall be thy fool" instead of "and he shall be thy lord." The word not was omitted by Barker, the king's printer in England in 1632, in printing the seventh commandment. He was fined £3,000 on this account.

4/2

NUMBER OF WORDS AND EMS TO THE SQUARE INCH.

Sizes of type.	Number of words.		Number of ems.
	Solid.	Leaded.	
14-point	11	8	26½
12-point	14	11	36
11-point	17	14	43
10-point	21	16	52
8-point	32	23	81
6-point	47	34	144
5-point	69	50	207

CHAPTER XII.

POST OFFICE AFFAIRS.*

PART I.

STATISTICAL INFORMATION.

UNITED STATES POST OFFICE.

For the first time since 1883 the annual financial statement of the Post Office Department of the United States, shows a surplus instead of a deficit. The revenues for the fiscal year ending June 30, 1911, amounted to $237,879,823.60 and the expenditures to $237,660,705.48, leaving a surplus of $219,118.12. The wiping out of the deficit has been accomplished without curtailment of postal facilities. On the contrary, important extensions have been made in every branch of the service.

SUMMARY OF ALL CLASSES DOMESTIC MAIL SERVICE IN OPERATION JUNE 30, 1911.

Number of routes	12,208
Length of routes, miles	2,710,894,592
Number of miles traveled per annum	483,683,998.79
Annual rate of expenditure	$77,689,935.44
Average rate of cost per mile of length	$286.58
Average rate of cost per mile traveled, cents	16.06
Average number of trips per week	17.15

SOURCE OF REVENUE.

	Total for fiscal year.
Sale of postage stamps, stamped envelopes, postal cards, etc.	$213,666,348.47
Second-class postage, paid in money	8,933,098.93
Third and four class postage, paid in money	5,049,918.73
Box rents	4,406,843.78
Miscellaneous receipts	95,726.42
Letter postage, paid in money	355,223.54
Fines and penalties	67,542.77
Dead letters	32,854.65
Revenue from money-order business	4,792,453.12
Unpaid money orders more than 1 year old	478,314.28
Total	$237,878,324.69

EXPENDITURE BY ITEMS FOR YEAR 1911.

Service in post offices:	
Salaries of postmasters	$28,284,964.11
Salaries of clerks, etc.	40,364,930.39
City Delivery Service	33,165,067.58
All other expenditures	11,083,406.74
Total	$112,898,368.82
Railway Mail Service	$20,106,909.40
Rural Delivery Service	37,145,756.65
Transportation of domestic mail:	
By railroads	$50,583,122.96
By other means of transportation	13,175,365.83
Total	$63,758,488.79
Transportation of foreign mail	$3,315,349.28
Payments on account of invalid money orders	$424,053.74

RAILROAD TRANSPORTATION.

SERVICE AND EXPENDITURE.

Number of routes	3,378
Length of routes, miles	223,899.91
Annual travel, miles	449,654,863.96
Annual rate of expenditure	$46,172,472.93
Average rate of cost per mile of length	$206.21
Average rate of cost per mile traveled, cents	10.26
Average number of trips per week	19.31

On June 30, 1911, there were in operation 171 full railway post-office lines, manned by 1,750 crews of 8,429 clerks (including 88 acting clerks). Of these 171 full lines, 151 had apartment-car service, manned by 987 crews, of 1,489 clerks. There were also 1,413 apartment railway post-office lines, manned by 4,208 crews, of 5,543 clerks; 18 electric car lines, with 20 crews, of 21 clerks; 55 steamboat lines, with 101 crews, of 93 clerks; a total of 1,657 lines of all kinds, manned by 15,575 clerks, representing the working force of the lines. In addition there were 30 officials, 130 chief clerks, 784 transfer clerks employed in handling the mails at important junction points, and 509 clerks detailed to clerical duty in the various offices of the service—an aggregate of 17,028 employees in the service.

(Continued on page 324.)

* This chapter is divided into two parts; the first gives statistics relative to the Post Office Affairs of the United States and the World, the second deals with information relative to rates, etc., domestic and foreign and the "Parcels Post." Revised through the courtesy of Postmaster-General Hitchcock.

(Continued from page 323.)

Of the 1,464 full railway post-office cars in use and in reserve, 869 are all-steel cars, 147 steel-underframe cars, and 948 wooden cars, and of the 3,819 apartment cars in use and in reserve, 111 are all-steel cars, 106 steel-underframe cars, and 3,602 wooden cars.

In view of the rapid development of the aeroplane as a practical means of aerial transportation, recommendation has been made for an appropriation of $50,000 for an experimental aerial mail service. During the past year a number of experiments in aerial mail transportation have been permitted, without expense to the department, and it is desired to give this method of transportation a test under more practical conditions where other modes of transportation are difficult.

MAIL SERVICE IN OPERATION YEAR ENDING JUNE 30, 1911.

Service.	Number.	Aggregate length.	Annual rate of expenditure.
		Miles.	
Star service in Alaska	22	4,248	$196,896.93
Steamboat service	226	29,283.91	758,109.88
Railroad routes	3,378	223,899.91	46,172,472.93
Railway post-office cars			4,737,788.75
Railway Mail Service (officers and clerks)	17,028		[1] 20,152,904.18
Mail-messenger routes	7,739	5,128.51	1,591,676.97
Wagon routes (in cities)	290	1,127.24	1,643,332.70
Electric and cable car routes	547	7,347.44	681,073.72
Pneumatic-tube routes	6	54.4492	925,636.40
Mail equipment			[1] 428,153.04
Freight on mail bags, postal cards, etc			[1] 401,598.19
Miscellaneous expenses			[1] 291.75
Total inland service			77,689,935.44
Foreign mails:			
Aggregate cost		$3,519,036.26	
Less intermediary service to foreign countries		$314,436.09	
			3,204,600.17
Total			80,894,535.61

[1] Actual expenditure.

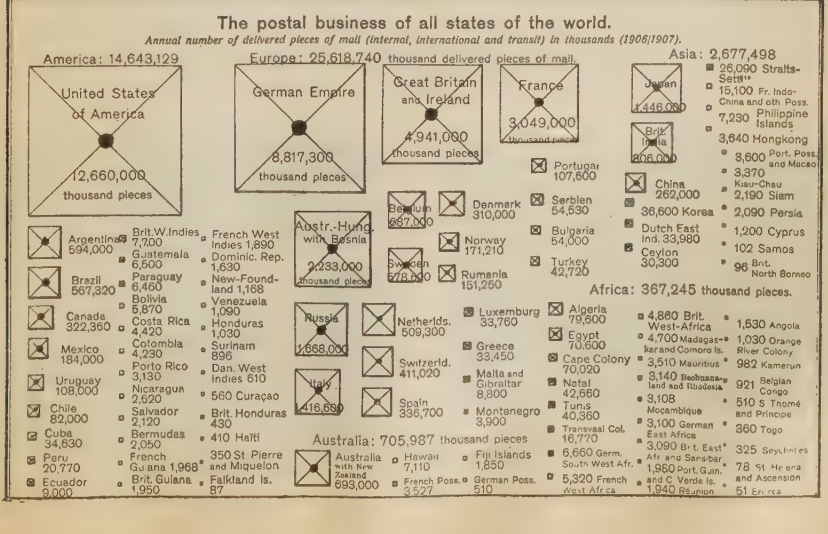
COMPARISON OF REVENUES AND EXPENDITURES OF THE POST OFFICE, YEAR ENDING JUNE 30, 1911.

Items.	Fiscal year.	
	1910	1911
REVENUES.		
Ordinary postal revenues	$219,338,536.62	$232,607,557.29
Revenues from money-order business	4,790,121.00	5,272,266.31
Total revenues from all sources	224,128,657.62	237,879,823.60
EXPENDITURES.		
Expenditures on account of the current year	223,190,830.39	230,516,814.45
Expenditures on account of previous years	6,786,394.11	7,132,112.23
Total expenditures during the year	229,977,224.50	237,648,926.68
Total revenues during the year	224,128,657.62	237,879,823.60
Excess of expenditures over revenues	5,848,566.88	
Excess of revenues over expenditures		230,896.92
Amount of losses by fire, burglary, bad debts, etc	32,915.07	11,778.80
Deficit in the postal revenues for the fiscal year ended June 30, 1910	5,881,481.95	
Surplus in the postal revenues for the fiscal year ended June 30, 1911		219,118.12

EXPENDITURES, APPROPRIATIONS AND ESTIMATES FOR ALL TRANSPORTATION SERVICES EXCEPT RURAL DELIVERY AND STAR ROUTE SERVICE.

Service, etc.	Expenditures for fiscal year ended June 30, 1911.	Appropriation for fiscal year ending June 30, 1912.	Estimate for fiscal year ending June 30, 1913.
Star service in Alaska	[1] $194,112.09	$250,000.00	$250,000.00
Steamboat service	775,416.32	790,900.00	882,000.00
Mail-messenger service	[1] 1,553,590.89	1,605,000.00	1,689,000.00
Pneumatic-tube service	904,092.11	966,800.00	979,600.00
Wagon service (in cities)	1,659,744.07	1,862,500.00	1,748,000.00
Mail bags, etc	283,382.38	285,000.00	282,000.00
Labor in mail-bag repair shop	98,813.63	110,000.00	102,000.00
Subworkshop, Chicago, Ill	3,258.81	3,000.00	2,400.00
Mail locks and keys	8,131.42	12,000.00	12,000.00
Labor in mail-lock repair shop	33,845.20	36,500.00	36,500.00
Railroad transportation	46,498,000.27	[2] 50,092,200.00	48,150,000.00
Tabulating information relative to railroad companies	13,571.64	10,000.00	.....
Freight on mail bags, postal cards, etc	363,112.89	[3] 425,000.00	525,000.00
Railway post-office cars	4,729,495.84	5,010,000.00	4,783,000.00
Railway mail service	20,101,303.11	21,748,280.00	22,780,163.00
Electric and cable car service	688,952.20	725,500.00	734,000.00
Parcel post service	.....	.....	50,000.00
Aerial mail service	.....	.....	50,000.00
Total inland service	77,908,822.87	83,932,680.00	83,055,663.00
Foreign mail service:			
Transportation	2,916,728.55	3,322,600.00	3,544,000.00
Assistant superintendent, New York, N. Y.	2,500.00	2,500.00	2,500.00
Balances due foreign countries	213,866.82	[4] 734,800.00	486,400.00
Miscellaneous expenses	291.75	1,000.00	1,000.00
Aggregate	81,042,209.99	87,993,580.00	87,089,563.00

[1] Star service, except in Alaska, transferred to office of Fourth Assistant Postmaster General.
[2] Includes $1,121,200 made immediately available and applied to deficiency for fiscal year 1911.
[3] Includes $48,200 made immediately available and applied to deficiency for fiscal years 1910 and 1911.
[4] Includes $247,400 made immediately available and applied to deficiency for fiscal year 1911.



POSTAL SERVICE OF

Name of Countries.	No. of Post Offices. 1	No. of Letter Boxes. 2	No. of Employees. 3	Number of Letters. Postage Prepaid. 4	Number of Letters. Not Prepaid. 5	Number of Post Cards. Single 6	Number of Post Cards. With reply paid. 7
Germany	50,563	153,187	232,153*	2,369,986,250	33,046,590	1,547,489,750	See Col. 6
Austria	10,106	43,317	69,733†	558,428,300	10,449,700	431,816,400	3,975,400
Belgium	1,597	10,795	10,360	134,586,478	591,292	93,129,686	274,664
Denmark	1,574	11,849	8,239	92,746,408	347,922	30,188,249	94,380
France	14,016	83,100	109,191†	1,206,155,972	4,285,461	15,214,650	81,050
Great Britain	24,245	70,765	212,814*	2,916,247,700	See Col. 4	884,962,800	See Col. 6
Italy	11,124	37,075	38,184	254,275,900	4,340,400	137,137,833	10,288,791
Japan	7,717	65,420	73,068†	328,253,356	See Col. 4	894,379,003	See Col. 6
Mexico	2,858	2,204	9,294	64,631,875	36,889	7,728,100	81,460
Norway	3,395	4,972	5,850	47,567,700	157,400	12,854,000	238,400
Netherlands	1,498	6,092	10,391	108,041,934	854,750	88,942,386	583,518
Portugal	4,044	6,077	7,313†	27,370,152	99,406	15,904,259	25,112
Russia	15,701	29,636	18,083	671,467,162	20,649,074	276,401,295	13,411,112
Spain	5,674	9,010	14,980	109,772,420‡	.....	8,815,992	18,576
Sweden	4,056	7,524	11,373	113,930,337	320,361	34,089,412	342,168
Switzerland	4,230	13,076	17,075	133,489,003	330,703	81,552,164	435,722

* Includes employees in postal, telegraph and telephone services.
† Includes employees in postal and telegraph services.

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FOREIGN MAIL SERVICES.

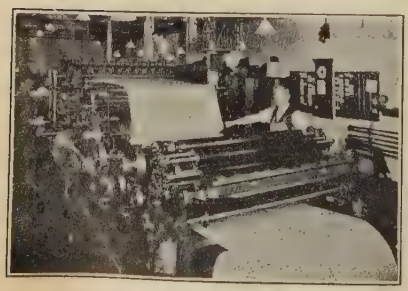
The cost of the Foreign Mail Service during the fiscal year ended June 30, 1911, was distributed as follows:

Trans-Atlantic service	$1,567,369.42
Trans-Pacific service	190,721.36
Miscellaneous service	703,783.49
Panama Railroad service for transit of mails of United States origin	60,659.02
Sea post service	77,093.23
Steamboat transfer service, New York, and other miscellaneous expenditures	919,409.74
Making the aggregate cost of the service	$3,519,036.26

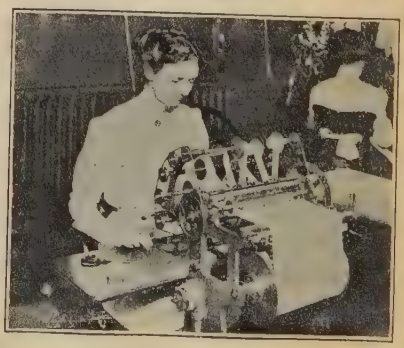
The weights of the mails dispatched by sea to foreign countries was:

	Pounds.
Letters and post cards	2,908,678
Other articles	16,972,033
Total	19,880,711

In the Trans-Pacific service, steamers of United States register carried a total of 18,986,929 grams, equal to 41,866 pounds of letters, and 251,110,593 grams, equal to 553,698 pounds of prints; and the total compensation they received was $111,974.84.



PRINTING POSTAL CARDS.
This work is now done in the Government Printing Office at Washington.



COILING POSTAGE STAMPS

THE WORLD—Domestic.

Printed matter. 8	Commercial papers. 9	Samples of merchandise. 10	Total including free matter. 11	Money orders. Number 12	Money orders. Value in dollars. 13
1,440,102,130	19,141,080	64,515,140	5,609,082,570	186,891,690	$2,346,241,523.19
142,747,200	.....	14,763,700	1,265,338,900	31,143,956	298,828,287.65
378,410,209§	3,428,282	6,774,326	653,013,713	4,370,217	79,451,574.48
15,780,341	.....	717,064	139,874,364	4,323,200	48,003,081.13
1,784,221,310	52,688,462	71,241,393	3,247,152,480	60,454,209	519,107,524.36
1,197,212,000	See Col. 4	See Col. 4	4,958,422,500	137,994,000	433,653,166.80
645,443,157	7,003,370	8,560,100	1,136,853,951	24,064,001	505,239,303.30
217,555,454	16,137,795	6,942,134	1,516,685,410	17,055,517	116,541,934.85
83,407,251	128,019	246,705	160,834,364	1,522,101	26,172,637.70
8,680,100	102,500	285,600	75,990,500	817,694	12,466,373.34
240,769,620	.....	2,425,254	455,348,218	6,181,751	35,210,678.75
39,571,767	628,081	1,040,443	87,385,949	767,362	10,850,547.05
131,690,955	10,318,290	10,150,678	1,338,676,368	39,710,581	1,077,529,662.86
128,124,000	.....	1,183,092	266,341,256	.....	.....
35,935,874	483,651	942,508	191,327,181	7,304,614	67,758,990.44
59,220,802	.....	1,463,725	295,262,417	6,349,307	119,134,990.98

‡ Prepayment of ordinary letters is required in Spain.
§ Includes 9,640,852 visiting cards mailed in open envelopes.
Munn & Co., Inc.

VALUE OF POSTAGE STAMPS ISSUED IN THE UNITED STATES, YEAR ENDING JUNE 30, 1911.

Postage stamps.	Ordinary.	Postage due.
1-cent	3,798,961,039	10,393,419
1-cent, in coils	37,940,000	.....
1-cent, in stamp books	203,084,376	.....
2-cent	5,130,249,018	28,747,919
2-cent, in coils	106,635,000	.....
2-cent, in stamp books	312,601,032	.....
3-cent	68,871,439	601,889
3-cent, in coils	223,500	.....
4-cent	96,049,509	.....
4-cent, in coils	161,000	.....
5-cent	119,640,739	1,972,299
5-cent, in coils	100,500	.....
6-cent	40,583,609	.....
8-cent	31,197,039	.....
10-cent	82,263,539	6,076,169
13-cent	603,244	.....
15-cent	16,093,089	.....
30-cent	.....	6,179
50-cent	697,787	1,657
1-dollar	110,492	.....
2-dollar	131	.....
5-dollar	2,646	.....
10-cent special delivery	15,371,040	.....
Total	10,061,439,768	47,799,531
Value	$180,957,385.76	$1,405,863.29

The total issue of postage stamps, stamp books, stamped envelopes, newspaper wrappers, postal cards and international reply coupons for the fiscal year ending June 30, 1911, was $202,553,755.61. The international reply coupons was the smallest item, the amount being only $5,422.80.

POSTAL SERVICE OF THE WORLD—Continued.

Foreign postal matter sent out.	Number of Letters.		Number of post cards		Printed matter.	Commercial papers.	Samples of merchand'e	Total including free matter.	Money orders issued.	
	Postage prepaid. 1	Not prepaid. 2	Single. 3	With reply paid. 4	5	6	7	8	Number. 9	Value in dollars. 10
Germany	151,889,520	1,507,700	63,790,260	Inc. Col. 3	103,976,410	1,027,120	9,174,530	331,961,780	4,572,640	$50,457,842.80
Austria	122,707,120	2,387,640	58,607,720	441,400	65,145,300	103,430	7,094,840	259,321,950	4,980,601	56,451,926.18
Belgium	37,564,509	170,308	13,969,973	30,713	29,372,629	307,266	1,987,093	83,506,644	747,629	10,317,820.14
Denmark	10,736,752	68,237	3,259,945	6,201	2,488,239	43,290	273,429	16,876,093	242,882	3,159,968.15
France	101,877,845	400,065	6,011,230	219,175	107,754,298	1,043,217	7,874,411	225,180,241	1,914,217	20,537,961.64
Great Britain	151,921,500	1,704,400*	19,788,600	Inc. Col. 3	95,865,900	Inc. Col. 5	Inc. Col. 5	269,280,400	817,965	13,335,080.15
Italy	39,918,360	1,605,442	10,750,830	116,665	22,021,373	267,034	1,937,159	76,734,481	476,377	7,174,475.27
Japan	13,618,682	30,376	7,570,478	56,334	8,671,082	182,732	301,845	30,807,505	21,751	328,713.74
Mexico	8,895,736	12,675	2,080,386	3,690	3,825,279	19,055	50,203	15,045,462	131,035	3,460,951.92
Norway	6,329,687	69,121	1,628,666	1,807	1,523,574	40,014	85,852	9,715,784	289,226	2,212,662.97
Netherlands	21,320,165	203,679	8,466,456	66,482	13,921,420	160,258	1,280,113	45,487,995	486,749	3,973,048.98
Portugal	5,382,084	44,239	1,254,448	1,534	3,216,242	107,177	78,436	10,111,429	51,608	499,048.98
Russia	46,228,549	3,304,624	18,335,215	490,398	13,204,241	610,519	1,698,367	83,871,913	663,799	10,736,042.49
Spain	14,749,368	157,380	3,835,296	16,092	16,673,556	101,616	428,688	36,019,032	.....	.....
Sweden	8,955,045	210,457	2,503,879	5,252	2,110,407	52,234	160,381	14,058,898	386,732	3,562,003.56
Switzerland	25,207,284	424,433	20,252,313	58,078	14,872,141	221,679	1,605,597	62,830,977	1,810,703	15,636,730.30

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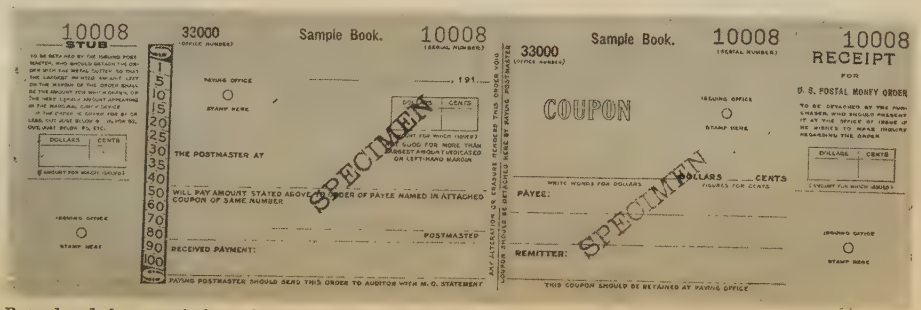
* Includes all free matter.



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MODEL OF DOMESTIC MONEY ORDER FORM.

POSTAL SERVICE OF THE WORLD—Continued.

Foreign postal matter received.	Number of Letters.		Number of post cards		Printed matter.	Commercial papers.	Samples of merchand'e	Total including free matter.	Money orders paid.	
	Postage prepaid. 1	Not prepaid. 2	Single. 3	With reply paid. 4	5	6	7	8	Number. 9	Value in dollars. 10
Germany	148,451,590	1,723,960	93,394,410	See Col. 3	58,586,910	2,711,970	10,836,680	318,086,890	6,318,120	$63,316,763.09
Austria	135,133,520	1,456,480	80,814,500	590,490	43,944,680	267,340	7,196,550	272,432,330	6,967,269	86,491,374.73
Belgium	29,991,156	523,796	12,313,496	17,680	20,811,128	423,436	2,076,412	66,325,324	745,240	10,091,965.86
Denmark	8,771,737	117,481	3,774,576	3,939	3,350,295	38,961	487,604	16,544,593	406,565	3,428,029.90
France	94,323,337	401,500	5,568,893	239,594	52,216,049	865,165	3,977,829	157,592,367	2,042,288	26,218,434.08
Great Britain	128,876,000	2,376,300*	26,437,200	See Col. 3	43,188,000	See Col. 5	See Col. 5	200,877,500	7,886,000	54,302,094.00
Italy	39,151,208	1,562,340	10,225,720	121,261	21,386,254	260,643	1,946,510	74,767,386	615,134	16,076,248.63
Japan	10,688,894	59,478	7,091,930	40,884	4,240,954	104,255	175,474	24,892,420	180,954	4,473,783.18
Mexico	10,560,800	26,520	1,487,652	4,526	11,954,387	22,623	130,574	24,394,873	176,618	2,847,030.69
Norway	7,765,316	98,020	2,312,375	4,862	3,542,175	20,566	306,267	14,072,773	222,577	4,526,209.37
Netherlands	27,651,412	311,563	7,984,987	50,526	13,035,961	187,178	1,260,590	50,541,328	628,688	6,177,604.60
Portugal	5,930,461	47,629	1,217,326	2,782	3,629,335	155,089	264,960	11,273,436	33,296†	497,043.52†
Russia	67,370,079	1,029,654	27,273,656	1,407,799	30,242,600	1,291,799	2,974,037	131,589,624	1,097,244	18,143,621.09
Spain	19,668,120	259,188	2,847,492	29,532	31,941,888	244,188	1,280,544	56,356,692	.....	.....
Sweden	12,329,596	141,453	3,474,497	4,888	5,301,075	70,460	650,923	22,023,072	347,967	6,147,733.80
Switzerland	29,419,697	916,808	16,810,843	43,823	19,263,467	218,998	1,995,838	68,811,265	1,077,238	12,568,809.25

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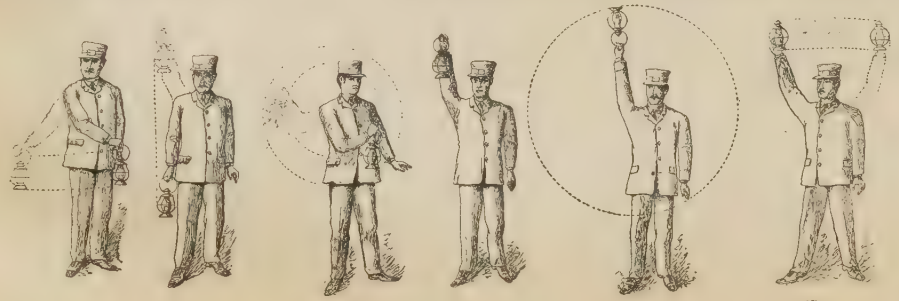
* Includes all free matter. † Includes money orders by telegraph.



(a) (b) (c) (d) (e) (f)

STANDARD LAMP SIGNALS ON RAILROADS.

(a) STOP — Swing crosswise of track.

(b) PROCEED—GO AHEAD—Raise up and down.

(c) BACK—Swing vertically in circle above head.

(d) RELEASE AIR BRAKE.—Hold lamp above head.

(e) TRAIN HAS PARTED.—Swing in circle at arm's length.

(f) APPLY AIR BRAKE.

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ESTIMATED TOTAL MAIL DELIVERED AND COLLECTED BY RURAL DELIVERY CARRIERS ANNUALLY, BASED ON A COUNT IN MAY, 1911.

Class of matter.	Delivered.		Collected.		Total.	
	Number.	Weight.	Number.	Weight.	Number.	Weight.
		Pounds.		*Pounds.*		*Pounds.*
First class:						
Letters	462,346,951	12,224,392	260,288,602	6,086,496	722,635,553	18,310,888
Postal cards	220,824,766	2,707,168	128,116,628	1,530,636	348,941,394	4,237,804
Miscellaneous	1,488,779	303,453	302,740	65,276	1,791,519	368,729
Total	684,660,496	15,235,013	388,707,970	7,682,408	1,073,368,466	22,917,421
Second class:						
Newspapers	996,710,156	175,322,207	1,459,579	333,379	998,169,735	175,655,586
Magazines	95,318,801	29,165,207	225,608	82,890	95,544,409	29,248,097
Free in county	169,349,819	24,557,233	124,710	19,286	169,474,529	24,576,519
Transient	11,606,341	2,542,016	3,178,762	600,019	14,785,103	3,142,035
Total	1,272,985,117	231,586,663	4,988,659	1,035,574	1,277,973,776	232,622,237
Third class:						
Books	4,033,761	3,364,075	256,209	175,066	4,289,970	3,539,141
Circulars	258,855,886	20,331,815	3,804,808	271,634	262,660,694	20,603,449
Miscellaneous	34,723,736	7,840,204	1,637,869	361,915	36,361,505	8,202,119
Total	297,613,383	31,536,094	5,698,886	808,615	303,312,269	32,344,709
Fourth class:						
Merchandise packages	30,161,408	14,266,782	3,255,429	1,463,269	33,416,837	15,730,051
Franked and penalty:						
Franked letters	4,125,727	295,126	230,649	10,898	4,356,376	306,024
Franked documents	6,450,969	1,292,804	108,277	27,404	6,559,246	1,320,208
Penalty letters	11,591,630	548,580	1,060,715	58,511	12,652,345	607,091
Penalty documents	3,600,444	487,313	102,139	18,659	3,702,583	505,972
Total	25,768,770	2,623,823	1,501,780	115,472	27,270,550	2,739,295
Foreign:						
Letters	4,683,176	200,392	2,295,487	110,171	6,978,663	310,563
Miscellaneous	2,262,328	374,018	305,852	44,292	2,568,180	418,310
Total	6,945,504	574,410	2,601,339	154,463	9,546,843	728,873
Registered:						
Letters	1,165,474	119,937	734,593	65,300	1,900,067	185,237
Miscellaneous	376,651	225,557	129,617	52,718	506,268	278,275
Total	1,542,125	345,494	864,210	118,018	2,406,335	463,512
Grand total	2,319,676,803	296,168,279	407,618,273	11,377,819	2,727,295,076	307,546,098

RURAL DELIVERY.

On June 30, 1911, service was in operation on 41,656 routes served by 41,559 carriers at an annual cost of $37,130,000.

The total mileage of rural routes in operation June 30, 1911, was 1,007,772, and the daily travel by carriers was 1,000,277 miles, the average mileage per route being 24.19. Excluding the cost of substitutes and of toll and ferry service, the average cost per mile traveled was $0.11775.

GROWTH OF THE SERVICE.

There were 41,656 routes in operation on June 30, 1911; of these 608 routes were operated tri-weekly, being an increase of 108 over the previous year.

In 1897 there were 82 routes, for which an appropriation of $40,000 was made; the expenditure that year was $14,840. In 1900 there were 1,259 routes, the appropriation was $450,000, the expenditure $420,433, which was an increase of $270,421 over that of the preceding year. In 1905 the number of routes was 32,055, the appropriation $21,116,600, the expenditure $20,864,885, an excess of $8,219,610 over that of the year before. In 1911 there were 41,656 routes, the appropriation was $38,860,000, the expenditure $37,126,812, an increase of $212,043 over the expenditure of 1910.

AMOUNT OF MAIL HANDLED.

In May, 1911, a count was made of the amount and weight of mail of all classes delivered and collected by the rural-delivery carriers. From this count the estimate given in the table above has been made of the amount and weight of mail handled annually on rural routes.

The first aerial dispatch of United States mail occurred in September, 1911, when 43,000 pieces were carried from Aeroplane Postal Station No. 1 on Nassau Boulevard to Mineola, Long Island. The progress being made in the science of aviation encourages the hope that ultimately the regular conveyance of mail by this means may be practicable. Such a service, if found feasible, might be established in many districts where the natural conditions preclude other means of rapid transportation.

PARCELS DISPATCHED TO AND RECEIVED FROM FOREIGN COUNTRIES DURING THE FISCAL YEAR ENDING JUNE 30, 1911, AND INCREASE OVER PREVIOUS YEARS.

Country.	Dispatched.				Received.			
	Number.	Per cent increase.	Weight.	Per cent increase.	Number.	Per cent increase.	Weight.	Per cent increase.
			Pounds.				*Pounds.*	
Australia	12,572	16.30	37,040	35.72	2,895	2.25	7,334	16.45
Austria	9,091	33.02	22,333	41.23	2,115	17.37	12,376	25.02
Bahamas	4,559	9.67	10,891	15.75	583	2.35	1,143	[1] 14.15
Barbados	4,009	17.74	9,598	19.39	1,017	15.18	1,785	12.42
Belgium	4,372	24.20	8,810	27.16	2,555	25.61	12,631	56.34
Bermuda	4,564	32.51	9,211	36.03	1,480	14.15	3,304	21.36
Bolivia	6,416	77.80	49,163	78.95	83	13.70	207	12.44
Brazil [2]	145	.....	620	.....	.....	.....	.....	.....
British Guiana	2,290	9.90	4,829	14.00	337	13.12	694	11.90
Chile	6,538	20.03	34,064	24.90	715	65.34	2,356	13.65
China [3]	9,383	935.65	28,269	236.41	2,244	194.27	6,450	48.53
Colombia	18,444	33.82	114,535	36.30	449	48.67	1,544	49.03
Costa Rica	12,644	20.00	71,215	36.03	340	5.20	1,112	[1] 22.77
Danish West Indies	2,663	10.26	6,927	17.20	198	[1] 16.46	458	[1] 15.18
Denmark	7,187	14.13	12,565	17.98	7,390	8.61	21,342	11.00
Dutch Guiana	284	97.22	799	130.92	65	200.00	253	22.02
Ecuador	5,838	40.00	32,616	51.37	209	8.30	612	4.25
France	9,848	14.39	15,579	20.79	3,357	43.28	12,680	64.46
Germany	54,505	[1] 2.30	143,681	10.18	115,532	12.88	774,731	13.48
Great Britain and Ireland	166,768	20.20	279,368	27.53	115,755	22.77	466,790	20.56
Guatemala	11,399	111.13	51,278	69.23	114	13.10	470	7.06
British Honduras	3,663	13.02	8,605	7.41	249	6.40	468	[1] 25.00
Republic of Honduras	5,340	7.55	26,976	.77	61	31.13	140	37.50
Haiti [4]	112	.....	291	.....	.....	.....	.....	.....
Hongkong	2,133	[1] 11.75	6,770	8.89	1,111	[1] 18.07	2,546	[1] 19.63
Hungary [5]	5,696	.....	12,630	.....	1,398	.....	8,195	.....
Italy	42,208	19.00	93,472	42.02	15,076	9.22	112,181	.86
Jamaica	12,981	8.22	26,219	2.17	2,420	23.53	4,609	27.00
Japan	33,460	[1] 11.13	89,319	[1] 4.40	36,915	9.40	119,714	30.12
Leeward Islands	2,376	4.71	6,905	7.10	412	([6])	950	3.15
Mexico	74,478	10.04	365,241	[1] .43	17,569	4.53	41,281	[1] 32.59
Netherlands	3,371	20.40	8,166	40.91	1,040	28.90	3,972	12.39
Newfoundland	5,599	18.40	9,682	22.10	1,056	10.47	2,865	17.08
New Zealand	6,698	10.42	22,589	12.21	1,031	3.50	2,759	[1] 81.56
Nicaragua	5,342	72.10	28,846	89.96	50	13.63	135	5.40
Norway	14,221	11.41	22,842	60.00	14,433	59.25	28,907	12.35
Peru	7,060	38.51	39,017	37.80	386	22.93	1,131	11.76
Salvador	4,357	21.06	27,073	23.07	81	15.71	339	59.05
Sweden	20,547	21.65	33,166	2.19	6,683	27.73	19,287	24.90
Trinidad	3,467	29.27	9,564	38.75	770	12.24	1,585	6.30
Uruguay	1,089	37.32	3,885	27.88	67	76.32	197	18.73
Venezuela	6,599	6.83	37,636	7.69	199	[1] 66.04	753	25.85
Windward Islands	936	7.46	2,338	22.09	189	40.00	438	41.19
Total	615,260	.....	1,824,623	.....	359,219	.....	1,680,724	.....

[1] Decrease.
[2] Convention effective May 29, 1911.
[3] Received in parcel mails from Hongkong and Japan.
[4] Convention effective May 1, 1911.
[5] Convention effective July 1, 1910.
[6] No change.

During the last fiscal year the Department paid $1,546,088.68 for the manufacture of stamped envelopes and newspaper wrappers. Under the new contract beginning July 1, 1911, the prices for the four-year term will be $297,880 less than the same quantities would have cost under the old contract.

The annual rate of expenditure for the salaries of presidential postmasters on July 1, 1911, was $14,216,700, as follows: First class, $1,579,600; second class, $4,494,800; third class, $8,142,300.

To reward postal employees for the invention of labor-saving devices legislation was obtained as follows:

"The Postmaster General is hereby authorized to pay, in his discretion, rewards to postal employees whose inventions are adopted for use in the postal service, and for that purpose the sum of $10,000 is hereby appropriated."

The postal service is using nearly 2,000,000,000 yards of jute twine yearly for tying packages of letters.

MAILINGS OF SECOND-CLASS PUBLICATIONS.

Totals of the number of publications of the various frequencies of issue and news agents mailing at the pound rate of postage June 30, 1911.

Daily	2,569
Tri-weekly	66
Semi-weekly	673
Weekly	17,373
Semi-monthly	538
Monthly	4,952
Bi-monthly	307
Quarterly	1,291
Other periods	95
Total	27,864
News agents	3,046
Publications admitted under the act of March 3, 1879	26,504
Publications admitted under the act of July 16, 1894	1,346
Publications admitted under the act of June 6, 1900	14
Total	27,864

Stamps were first introduced in America by the English Stamp Act of 1765; this act was opposed by the First American Congress in Nov. 1765 and repealed in 1776.

Number of pounds of second-class matter mailed at the cent-a-pound and free-in-county rates during the fiscal year ended June 30, 1911:

Subscribers' copies:	
Free in county	57,704,761
At cent-a-pound rate	880,422,146
Sample copies at cent-a-pound rate	12,874,762
Total at cent-a-pound rate	893,296,908
Total mailings at cent-a-pound rate and free-in-county	951,001,669

Estimated weights of mailings of second-class matter at other than the cent-a-pound and free-in-county rates during the fiscal year 1911, based on the special weighing of mails in 1907:

	Pounds.
At transient second-class rate of 1 cent for each 4 ounces	30,427,074
At special rate of 1 cent a copy	1,763,585
At special rate of 2 cents a copy	3,605,551
Total	35,796,210

RECAPITULATION.

Weight of mailings of second-class matter at the cent-a-pound and free-in-county rates	951,001,669
Weight of mailings at other rates	35,796,210
Aggregate weight of mailing of second-class matter	986,797,879

REGISTERED MAIL ITEMS WITH TOTAL AMOUNTS FOR THE YEAR ENDING JUNE 30, 1911.

Paid registrations:	
Domestic letters	26,153,943
Domestic parcels	7,375,274
Foreign letters	4,219,872
Foreign parcels	781,022
Official paid	113,079
Total paid registrations	38,643,190
Official letters and parcels registered free	3,973,450
Official free (special)	149,819
Total free registrations	4,123,269
Total number of letters and parcels registered, paid and free	42,766,459
Distribution letters and parcels re-registered free	1,493,449
Aggregate number of letters and parcels registered, paid, official free, and distribution free	44,259,908
Total free and distribution re-registered free	5,616,718
Amount collected for registry fees	$3,864,319.00

GROWTH OF THE DOMESTIC MONEY-ORDER SYSTEM.

For the year ending June 30, 1911, the total number of money-order offices in operation was 51,809; the number of orders issued was 81,146,233, their value $578,111,005.11; the number of orders paid and repaid, 81,481,930, their value $578,246,320.76; the number of excess of payments and repayments over issues, 335,697, their value $135,315.65; the amount in fees received, $4,840,722.59; average amount of orders, $7.12; average amount of fees, $0.0557.

STAMP BOOKS.

During the fiscal year ending June 30, 1911, 26,716,406 stamp books were issued, having a value of $8,550,028.46.

STAMP COILS.

During the fiscal year ending June 30, 1911, 276,285 stamp coils were issued for use in stamping machines. The total value of the stamps which were made up in coils was $2,549,563.75.

POSTAL CARDS.

During the fiscal year ending June 30, 1911, 975,138,748 postal cards were issued, having a value of $9,988,422.98. By far the largest number of postal cards were the one-cent card bearing a portrait of the late President McKinley. There were 944,927,198 cards issued of this variety.

STAMPED ENVELOPES AND NEWSPAPER WRAPPERS.

During the fiscal year ending June 30, 1911, 494,838,140 ordinary stamped envelopes and wrappers were issued, the value being $9,109,652.93, while 1,195,937,245 return card envelopes were issued, having a value of $24,715,647.92, making a total of 1,690,775,385, with a value of $33,825,300.85.

Fees of 8 cents each on special delivery mail were claimed by postmasters last year to the total amount of $1,340,519.94, indicating that 16,756,499 pieces of mail of this character were delivered, being an increase of 1,316,467 pieces over last year, or 8.52 per cent. These figures relate to all post offices, irrespective of class.

IMITATIONS OF STAMPS.

No adhesive stamps, of any form or design whatever, other than lawful postage stamps, are permitted to be affixed to the address side of domestic mail matter, but such adhesive stamps, provided they do not in form resemble lawful postage stamps, and do not bear numerals, may be affixed to the reverse side of domestic mail matter.

PART II.

PRACTICAL POSTAL INFORMATION.

DOMESTIC MAIL MATTER.

CLASSIFICATION.

1. Domestic mail matter includes matter deposited in the mails for local delivery, or for transmission from one place to another within the United States, or to or from or between the possessions of the United States, and is divided into four classes:

First. Written and sealed matter, postal cards and private mailing cards.

Second. Periodical publications. (Rates for publishers and news agents only.)

Third. Miscellaneous printed matter (on paper).

Fourth. All matter not included in previous classes.

2. Porto Rico and Hawaii are included in the term "United States." The Philippine Archipelago, Guam, Tutuila (including all adjacent islands of the Samoan group which are possessions of the United States), and the Canal Zone are included in the term "Possessions of the United States." The term "Canal Zone" includes all the territory purchased from the Republic of Panama, embracing the "Canal Zone" proper and the islands in the Bay of Panama named Perico, Naos, Culebra and Flamenco.

3. Domestic rates and conditions apply to mail matter addressed to officers or members of the crew of vessels of war of the United States, to matter sent to the United States Postal Agency at Shanghai, China, and, with certain exceptions, to that sent to Canada, Cuba, Mexico and the Republic of Panama. The domestic rate applies also to letters, but not to other articles, addressed to Great Britain, Ireland and Newfoundland, and to letters for Germany despatched only by steamers which land the mails at German ports.

4. Pamphlet of General Postal Information.—A pamphlet of general postal information has been issued for free distribution to the public through postmasters. It contains the classification, conditions and postage rates for domestic and foreign mail matter. The information given herewith is usually sufficient. A new edition of the pamphlet has just been issued.

FIRST-CLASS MATTER.

5. Written matter, namely: Letters, postal cards, private mailing cards (post cards), and all matter wholly or partly in writing, whether sealed or unsealed (except manuscript copy accompanying proof sheets or corrected proof sheets of the same) and the writing authorized by law to be placed upon matter of other classes. All matter sealed or otherwise closed against inspection is also of the first class.

Note.—Typewriting and carbon and letter press copies thereof are held to be an equivalent of handwriting and are classed as such in all cases.

DROP LETTERS.

6. See page 336.

POSTAL CARDS.

7. Postal cards issued by the Post Office Department may bear written, printed, or other additions as follows:

(a) The face of the card may be divided by a vertical line placed approximately one-third of the distance from the left end of the card; the space to the left of the line to be used for a message, etc., but the space to the right for the address only.

(b) Addresses upon postal cards . . . may be either written, printed or affixed thereto, at the option of the sender.

(c) Very thin sheets of paper may be attached to the card on condition that they completely adhere thereto. Such sheets may bear both writing and printing.

(d) Advertisements, illustrations or writing may appear on the back of the card and on the left third of the face.

(e) The addition to a postal card of matter other than as above authorized will annul its privileges as a postal card and subject it, when sent in the mails, to postage according to the character of the message—at the letter rate if wholly or partly in writing or the third-class rate if entirely in print. In either case the postage value of the stamp impressed upon the card will not be impaired.

(f) Postal cards must be treated in all respects as sealed letters, except that when undeliverable to the addressee they may not be returned to the sender.

(g) Postal cards bearing particles of glass, metal, mica, sand, tinsel or other similar substances are unmailable, except when enclosed in envelopes tightly sealed to prevent the escape of such particles with proper postage attached, or when treated in such manner as will prevent the objectionable substances from being rubbed off or injuring persons handling the mails.

Note.—Used postal cards which conform to the conditions prescribed for post cards may be remailed with one cent postage prepaid thereon.

8. Double postal cards should be folded before mailing. Intact double postal cards should be folded before mailing.

9. Either Half Usable Separately.—Either half of a double domestic postal card may be used separately, but postmasters will not separate them.

10. Mailing Reply Part With Initial Half Attached.—If the initial half of a double postal card be not detached when the reply half is mailed for return, the card is subject to postage according to the character of the message. The enclosure in a double postal card of unauthorized matter annuls its privileges as a postal card.

11. Reply Postal Cards to and from the Philippines.—The reply half of the Philippine double postal card of 1-cent denomination, overprinted with the word Philippine, shall be valid for postage when mailed in the United States and addressed to points in the Philippine Islands. The United States 1-cent double postal card may be mailed from the United States to the Philippine Islands, and by arrangement with the Bureau of Posts of the Philippines the reply half of the card is valid for postage when mailed in the Philippines and addressed to points in this country.

PRIVATE MAILING CARDS (POST CARDS).

12. Private mailing cards ("post cards") in the domestic mails must conform to the following conditions:

(a) A "post card" must be an unfolded piece of cardboard not exceeding 9 by 14 centimeters (approximately 3 9-16 by 5 9-16 inches) nor less than 7 by 10 centimeters (approximately 2 3-4 by 4 inches).

(b) It must in form and in the quality and weight of paper be substantially like the Government postal card.

(c) It may be of any color not interfering with a legible address and postmark.

(d) It may or may not, at the option of the sender, bear near the top of the face the words "Post Card."

(e) The face of the card may be divided by a vertical line; the left half to be used for a message, etc., but that to the right for the address only.

(f) Very thin sheets of paper may be attached to the card, and then only on condition that they completely adhere thereto. Such sheets may bear both writing and printing.

(g) Advertisements and illustrations may appear on the back of the card and on the left half of the face.

(h) Cards, without cover, conforming to the foregoing conditions, are transmissible in the domestic mails (including the possessions of the United States) and to Cuba, Canada, Mexico, the Republic of Panama, and the United States postal agency at Shanghai, China, at the postage rate of 1 cent each.

(i) When post cards are prepared by printers and stationers for sale it is desirable that they bear in the upper right-hand corner of the face an oblong diagram containing the words "Place postage stamp here," and at the bottom of the space to the right of the vertical dividing line the words "This space for the address."

(j) Cards which do not conform to the conditions prescribed by these regulations are, when sent in the mails, chargeable with postage according to the character of the message—at the letter rate if wholly or partly in writing, or at the third-class rate if entirely in print.

(k) Cards bearing particles of glass, metal, mica, sand, tinsel or other similar substances are unmailable, except when enclosed in envelopes tightly sealed to prevent the escape of such particles, or when treated in such manner as will prevent the objectionable substances from being rubbed off or injuring persons handling the mails. Cards mailed under cover of sealed envelopes (transparent or otherwise) are chargeable with postage at the first-class rate; if enclosed in unsealed envelopes they are subject to postage according to the character of the message—at the first-class rate if wholly or partly in writing, or the third-class rate if entirely in print; and the postage stamps should be affixed to the envelopes covering the same. Postage stamps affixed to matter enclosed in envelopes cannot be recognized in payment of postage thereon.

ARTICLES INCLUDED IN FIRST-CLASS MATTER.

13. Assessment notices (printed) with amount due written therein. Albums (autograph) containing written matter. Blank books with written entries; bank checks filled out in writing, either canceled or uncanceled; legal and other blank printed forms signed officially. Blank forms, filled out in writing. Cards or letters (printed) bearing a written date, where the date is not the date of the card, but gives information as to when the sender will call or deliver something otherwise referred to, or is the date when something will occur or is acknowledged to have been received. Cards (printed) which by having a signature attached are converted into personal communications, such as receipts, orders for articles furnished by addressee, etc. Cards (visiting) bearing written name, except single cards enclosed with third or fourth class matter, and bearing the name of the sender. Certificates, checks, receipts, etc., filled out in writing. Communications entirely in print, with exception of name of sender, sent in identical terms by many persons to the same address. Copy (manuscript or typewritten) unaccompanied by proof sheets thereof. Diplomas, marriage or other certificates, filled out in writing. Drawings or plans containing written words, letters or figures, indicating size, price, dimensions, etc. Envelopes bearing written addresses. Folders made of stiff paper, the entire inner surface of which cannot be examined except at the imminent risk of breaking the seal, and those having many folds or pages, requiring the use of an instrument of any kind in order to thoroughly examine the inner surfaces are subject to the first-class rate of postage. Hand or typewritten matter and letter press or manifold (carbon) copies thereof. Imitations or reproductions of hand or typewritten matter not mailed at the post office window or other depository designated by the postmaster in a minimum number of twenty identical copies. Legal and other blank printed forms signed officially. Letters (old or remailed) sent singly or in bulk. Manuscripts or typewritten copy, when not accompanied by proof sheets thereof. Marriage certificates filled out in writing. Old letters sent singly or in bulk. Original typewritten matter and manifold or letter-press copies thereof. Plans and drawings containing written words, letters or figures, indicating size, price, dimensions, etc. Price lists (printed) containing written figures changing individual items. Receipts (printed) with written signatures. Sealed matter of any class, or matter so wrapped as not to be easily examined, except original packages of proprietary articles of merchandise put up so that each package may be examined in its simplest mercantile or sample form, and seeds and other articles that may be enclosed in sealed transparent envelopes. Stenographic or shorthand notes. Typewritten matter, original letter-press and manifold copies thereof. Unsealed written communications. Visiting cards (written), except single cards enclosed with third or fourth class matter, and bearing the name of the sender.

SECOND-CLASS MATTER.

14. Includes newspapers and periodicals bearing notice of entry as second-class matter. A pamphlet containing the laws governing mailable matter of the second class and regulations thereunder will be furnished postmasters, interested publishers and news agents.

THIRD-CLASS MATTER.

15. Printed matter under the following conditions is third-class matter:

16. Printed Matter Defined.—Printed matter is the reproduction upon paper by any process, except handwriting and typewriting, not having the character of actual personal correspondence, of words, letters, characters, figures or images, or any combination thereof. Matter produced by the photographic process (including blueprints) is printed matter.

17. Circulars.—A circular is defined by law to be a printed letter which, according to internal evidence, is being sent in identical terms to several persons. A circular may bear a written, typewritten or hand-stamped date, name and address of person addressed and of the sender, and corrections of mere typographical errors.

18. Where a name (except that of the addressee or sender), date (other than that of the circular), figure, or anything else is written, typewritten or hand stamped in the body of the circular for any other reason than to correct a genuine typographical error, it is

subject to postage at the first-class (letter) rate, whether sealed or unsealed.

19. Exception.—If such name, date or other matter be hand stamped, and not of a personal nature, the character of the circular as such is not changed thereby.

20. Reproductions or imitations of handwriting and typewriting obtained by means of the printing press, neostyle, hectograph, multigraph, or similar process, will be treated as third-class matter, provided they are mailed at the post office window or other depository designated by the postmaster in a minimum number of 20 perfectly identical, unsealed copies. If mailed in a less quantity they will be subject to the first-class rate.

21. Correspondence of the blind; mailable at the third-class rate.

22. Seeds, bulbs, roots, scions, etc.; mailable at the third-class rate of postage.

22a. Identical pieces of third-class matter mailed without stamps affixed.

ARTICLES INCLUDED IN THIRD-CLASS MATTER.

23. Address tags and labels (printed). Advertisements printed on blotting paper. Almanacs. Architectural designs (printed). Assessment notices, wholly in print. Blank notes (printed). Blanks (printed legal) and forms of insurance applications, mainly in print. Blind, indented or perforated sheets of paper containing characters which can be read by the blind, except such as are entitled to free transmission. Blue prints. Books (printed). Bulbs. Calendar pads mainly in print. Calendars (printed on paper). Canvassing and prospectus books with printed sample chapters. Cards printed on paper. Cards, printed, with perforations for carrying coin. Cards, Christmas, Easter, etc., printed on paper. Catalogues. Check and receipt books (mainly in print). Circulars. Clippings (press) with name and date of paper stamped or written in. Correspondence of the blind. Coupons, printed. Engravings and wood cuts (printed on paper). Grain in its natural condition (samples of). Imitations of hand or typewritten matter, when mailed at the post office window or other depository designated by the postmaster in a minimum number of 20 identical copies. Indented or perforated sheets of paper containing characters which can be read by the blind, except such as are entitled to free transmission. Insurance applications and other blank forms mainly in print. Labels and tags bearing printed addresses. Legal blanks (printed) and forms of insurance applications, mainly in print. Lithographs. Maps printed upon paper, with the necessary mountings. Memorandum books, mainly in print. Music books. Notes (blank printed). Order blanks and report forms, mainly in print. Photographs, printed on paper. Plans and architectural designs (printed). Plants. Postage stamps (cancelled or uncancelled). Postal cards, bearing printed advertisements, mailed in bulk. Post cards, bearing on the message side illustrations or other printed matter, mailed in bulk. Press clippings with name and date of paper stamped or written in. Price lists, wholly in print. Printed blank notes. Printed calendars. Printed labels. Printed plans and architectural designs. Printed tags and labels. Printed valentines. Proof-sheets (printed) with or without manuscript. Receipt and check books (mainly in print). Reproductions or imitations of hand or typewriting, by the neostyle, hectograph, mimeograph, electric pen, or similar process, when mailed at the post office window or other depository designated by the postmaster, in a minimum number of twenty identical copies. Roots. School copy books containing printed instructions. Scions. Seeds. Sheet music. Tags and labels, printed. United States Treasury notes. Valentines, printed on paper. Visiting cards (printed). Wood cuts and engravings (prints).

24. Permissible additions to third-class matter.—

(a) Such words as "Dear Sir," "My dear friend," "Yours truly," "Sincerely yours," "Merry Christmas," "Happy New Year," "With best wishes" and "Do not open until Christmas," or words to that effect, written upon third class matter are permissible inscriptions.

(b) Inscriptions in public library books.—Public library books, otherwise transmissible in the mails at the third-class rate of postage, shall not be subjected to a higher postage rate because of bearing thereon or therein, in writing or by means of hand-stamp, the shelf-number, date of donation or acquisition (or both), or any mark of designation which may be reasonably construed as an "inscription" within the meaning of the law (sec. 478, P. L. and R.) in the limited sense of a permanent library record, placed thereon by the librarian and in that connection only.

(c) A written designation of contents—such as "Book," "Printed matter," "Photo"—shall be construed as a permissible "inscription" upon mail matter of the third class.

(d) Incidental use of third-class matter as receptacles for coin.—The rate of postage on matter essentially third class (printed matter upon paper) is not affected by the fact that incidentally it contains a perforation which may be used for carrying coin.

(e) Serial numbers.—Serial numbers written or impressed upon, and so inserted in what would otherwise be third-class matter, do not increase that rating.

(f) Permissible enclosures.—"There may be enclosed with third-class matter, without changing the classification thereof, a single visiting or business card; a single printed order-blank, or a single printed combination order-blank and coin-card with envelope bearing return address; or a single postal card bearing return address."

FOURTH-CLASS MATTER.

25. Fourth-class matter is all mailable matter not included in the three preceding classes which is so prepared for mailing as to be easily withdrawn from the wrapper and examined, except that sealed packages of proprietary articles of merchandise (not in themselves unmailable), such as pills, fancy soaps, tobacco, etc., put up in fixed quantities by the manufacturer for sale by himself or others, or for samples, in such manner as to properly protect the articles, so that each package in its simplest mercantile or sample form may be examined, are mailable as fourth-class matter. It embraces merchandise and samples of every description, and coin or specie.

26. Postage must be paid by stamps affixed, unless 2,000 or more identical pieces are mailed at one time when the postage at that rate may be paid in stamps or money. New postage must be prepaid for forwarding or returning. The affixing of special delivery ten-cent stamps in addition to the regular postage entitles fourth-class matter to special delivery.

Articles of this class liable to injure or deface the mails, such as glass, sugar, needles, nails, pens, etc., must be first wrapped in a bag, box, or open envelope and then secured in another outside tube or box, made of metal or hard wood, without sharp corners or edges, and having a sliding clasp or screw lid, thus

securing the articles in a double package. The public should bear in mind that the first object of the department is to transport the mails safely, and every other interest is made subordinate.

ARTICLES INCLUDED IN FOURTH-CLASS MATTER.

27. Albums, photograph and autograph (blank). Artificial flowers. Bees (queen) when properly packed. Bill heads. Blank address tags and labels. Blank books. Blank books with printed headings. Blank cards or paper. Blank diaries. Blank postal cards in bulk packages. Blank post-cards. Blotting paper (blank). Botanical specimens, not susceptible of being used for propagation. Calendar pads, mainly blank. Calendars or other matter printed on celluloid. Card coin-holders (not printed). Cards (blank). Cards, printed playing, of all kinds. Celluloid, printed or unprinted. Christmas and Easter cards printed on other material than paper. Cigar bands. Coin. Combination calendar and memorandum pads mainly blank. Crayon pictures. Cut flowers. Cuts (wood or metal). Daguerreotypes. Dissected maps and pictures. Drawings, framed or unframed. Dried fruit. Dried plants. Easter cards, when printed on other material than paper. Electrotype plates. Engravings, when framed. Envelopes, printed or unprinted, except when addressed and enclosed singly with third-class matter. Flowers, cut or artificial. Framed engravings, pictures and other printed matter. Geological specimens. Letter heads. Maps, printed on cloth. Merchandise samples. Memorandum books and calendar pads, mainly blank. Merchandise sealed: Proprietary articles (not in themselves unmailable), such as pills, fancy soaps, tobacco, etc., put up in fixed quantities by the manufacturer for sale by himself or others, or for samples, in such manner as to properly protect the articles, and so that each package in its simplest mercantile or sample form may be readily examined. Metals. Minerals. Napkins, paper or cloth, printed or unprinted. Oil paintings, framed or unframed. Order blanks and report forms mainly blank (spaces covered by ruled lines being regarded as blank), are fourth-class matter. However, one copy may be enclosed with third-class matter without subjecting such matter to postage at the fourth-class rate. Paper bags and wrapping paper, printed or unprinted. Paper napkins, Patterns, printed or unprinted. Pen or pencil drawings, if they bear no written words, letters or figures, giving size, dimensions, distance, price, etc. Photograph albums. Photographic negatives. Postal cards (blank) in bulk packages. Post-cards (blank). Printed matter on other material than paper. Printed playing cards of all kinds. Private mailing or post-cards (blank). Queen bees, when properly packed. Record books, mainly blank. Rulers, wooden or metal, bearing printed advertisements. Samples of cloth. Samples of flour or other manufactured grain for food purposes. Sealed merchandise: Soap wrappers, Stationery. Tags (blank). Tape measures. Tintypes. Tobacco tags and wrappers. Valentines printed on material other than paper. Wall paper. Water color painting. Wooden rulers, bearing printed advertisements. Wrapping paper, printed or unprinted.

28. Permissible writing or printing upon or with fourth-class matter:

(a) The written additions permissible upon third-class matter may be added to fourth-class matter without subjecting the latter to a higher than the fourth-class rate of postage.

(b) The written additions permissible upon fourth-class matter may be placed upon the matter itself, or upon the wrapper or cover thereof, or tag or label accompanying the same.

(c) A written designation of the contents, such as "candy," "cigars," "merchandise," etc., is permissible upon the wrapper of fourth-class matter.

(d) Such inscriptions as "Merry Christmas," "Happy New Year," "With best wishes," and "Do not open until Christmas," or words to that effect, together with the name and address of the addressee and of the sender may be written on mail matter of the fourth class, or upon a card enclosed therewith, without affecting its classification.

RATES OF POSTAGE.

FIRST-CLASS MATTER.

Rates of postage on first-class matter.—(a) On letters and other matter, wholly or partly in writing, except the writing specially authorized to be placed upon matter of other classes, and on matter sealed or otherwise closed against inspection—2 cents an ounce or fraction thereof.

(b) On postal cards—1 cent each, the price for which they are sold.

(c) On private mailing cards (post-cards) conforming to the requirements of Postal Laws and Regulations—1 cent each.

(d) On "drop letters," 2 cents an ounce or fraction thereof when mailed at letter-carrier post offices, or at offices which are not letter-carrier offices if rural free delivery has been established and the persons addressed can be served by rural carrier; and 1 cent for each ounce or fraction thereof when mailed at offices where letter-carrier sevice is not established, or at offices where the patrons cannot be served by rural free-delivery carriers.

(e) Letters mailed at a post office for delivery to patrons thereof by star route carrier and those deposited in boxes along a star route or rural free delivery route are subject to postage at the rate of two cents an ounces or fraction thereof.

(f) Letters prepaid 1 cent received by a postmaster, under cover (through the mails), with postage prepaid on the bulk package at the letter rate, cannot be distributed for local delivery or transmission in the mails. Each letter must be prepaid at the regular first-class rate.

(g) A letter which—after a proper effort has been made to deliver it—is returned to the sender, may not be remailed without a new prepayment of postage, and it should be enclosed in a new envelope, to secure prompt transmission.

SECOND-CLASS MATTER.

When mailed by the public.—The rate of postage on newspapers and periodical publications of the second class, when sent by others than the publisher thereof, or a news agent, is 1 cent for each 4 ounces, or fractional part thereof, on each separately addressed copy or package of unaddressed copies, to be prepaid by stamps affixed.

NOTE.—There is no such rate of postage as 4 cents a pound.

When mailed by publishers or news agents.—Copies of publications admitted to the second class of mail matter when mailed by the publishers thereof to subscribers and as sample copies within the limitations of section 456, Postal Laws and Regulations, are subject to postage at the rate of 1 cent a pound, to be prepaid in money on the bulk weight of all copies, except as provided by section 452, Postal Laws and Regulations.

THIRD-CLASS MATTER.

The rate of postage on mail matter of the third class is 1 cent for each 2 ounces or fraction thereof, on each individually addressed piece or parcel, prepaid by stamps affixed, except as provided by section 483½, Postal Laws and Regulations.

NOTE.—There is no such rate of postage as 8 cents a pound.

FOURTH-CLASS MATTER.

The rate of postage on mail matter of the fourth class is 1 cent an ounce or fraction thereof, on each individually addressed piece or parcel, prepaid by stamps affixed, except as provided by amended section 483½, Postal Laws and Regulations.

NOTE.—There is no such rate of postage as 16 cents a pound.

MONEY ORDER SYSTEM.

Fees charged for money orders issued on domestic form.—

TABLE NO. 1.

Payable in the United States (which includes Guam, Hawaii, Porto Rico and Tutuila, Samoa); or payable in Bermuda, British Guiana, British Honduras, Canada, Canal Zone (Isthmus of Panama), Cuba, Mexico, Newfoundland, at the United States Postal Agency at Shanghai (China), in the Philippine Islands, or the following islands in the West Indies: Antigua, Bahamas, Barbados, Dominica, Grenada, Jamaica, Martinique, Montserrat, Nevis, St. Kitts, St. Lucia, St. Vincent, Trinidad and Tobago, and Virgin Islands.

For orders from	$ 0.01 to $ 2.50	3 cents
For orders from	$ 2.51 to $ 5.00	5 cents
For orders from	$ 5.01 to $10.00	8 cents
For orders from	$10.01 to $20.00	10 cents
For orders from	$20.01 to $30.00	12 cents
For orders from	$30.01 to $40.00	15 cents
For orders from	$40.01 to $50.00	18 cents
For orders from	$50.01 to $60.00	20 cents
For orders from	$60.01 to $75.00	25 cents
For orders from	$75.01 to $100.00	30 cents

21. Postmasters at domestic money-order offices must bear in mind that they are not authorized to issue money orders for payment in any foreign country other than those enumerated above. When an intending remitter applies at a domestic office for a money order payable in any other foreign country the postmaster should direct him to the nearest international money-order office.

22. Fees charged for money orders issued on international form.—

TABLE NO. 2.

Payable in Apia, Austria, Belgium, Bolivia, Cape Colony, Costa Rica, Denmark, Egypt, Germany, Great Britain and Ireland, Honduras, Hongkong, Hungary, Italy, Japan, Liberia, Luxemburg, Natal and Zululand, New South Wales, New Zealand, Orange River Colony, Peru, Portugal, Queensland, Russia, Salvador, South Australia, Switzerland, Tasmania, the Transvaal, Uruguay and Victoria.

For orders from	$ 0.01 to $ 2.50	10 cents
For orders from	$ 2.51 to $ 5.00	15 cents
For orders from	$ 5.01 to $ 7.50	20 cents
For orders from	$ 7.51 to $10.00	25 cents
For orders from	$10.01 to $15.00	30 cents
For orders from	$15.01 to $20.00	35 cents
For orders from	$20.01 to $30.00	40 cents
For orders from	$30.01 to $40.00	45 cents
For orders from	$40.01 to $50.00	50 cents
For orders from	$50.01 to $60.00	60 cents
For orders from	$60.01 to $70.00	70 cents
For orders from	$70.01 to $80.00	80 cents
For orders from	$80.01 to $90.00	90 cents
For orders from	$90.00 to $100.00	$1.00

TABLE NO. 3.

Payable in any foreign country not enumerated in Tables Nos. 1 and 2 above.

For orders from	$ 0.01 to $ 10.00	10 cents
For orders from	$10.01 to $ 20.00	20 cents
For orders from	$20.01 to $ 30.00	30 cents
For orders from	$30.01 to $ 40.00	40 cents
For orders from	$40.01 to $ 50.00	50 cents
For orders from	$50.01 to $ 60.00	60 cents
For orders from	$60.01 to $ 70.00	70 cents
For orders from	$70.01 to $ 80.00	80 cents
For orders from	$80.01 to $ 90.00	90 cents
For orders from	$90.01 to $100.00	$1.00

International orders.—There are now in operation conventions for the exchange of money orders between the United States and sixty-one countries named below:

*Antigua.
Apia, Samoa.
Austria.
*Bahama Islands.
*Barbados.
Belgium.
*Bermuda.
Bolivia.
*British Gu'ana.
*British Honduras.
*Canada.
*Canal Zone.
†Cape Colony.
Chili.
Costa Rica.
*Cuba.
Denmark.
*Dominica.
Egypt.
France, Algeria and Tunis.
Germany.
Great Britain and Ireland.
Greece.
*Grenada.
Honduras (Republic).
Hongkong (China).
Hungary.
Italy (including San Marino).
*Jamaica.
Japan.
Liberia.
Luxemburg.
*Martinique.
*Mexico.
*Montserrat.
†Natal and Zululand.
Netherlands.
*Nevis.
*Newfoundland.
New South Wales.
New Zealand.
Norway.
†Orange River Colony.
Peru.
*Philippine Islands.
Portugal.
Queensland.
Russia.
*St. Kitts.
*Saint Lucia.
*Saint Vincent.
Salvador.
South Australia.
Sweden.
Switzerland.
Tasman'a.
†The Transvaal.
*Trinidad and Tobago.
Uruguay.
Victoria.
*Virgin Islands.

* Draw orders on domestic money-order form.
† Cape Colony, Transvaal, Orange River Colony and Natal (with Zululand) have been consolidated into the South African Union, and all money-orders for payment in those countries are now certified by the Exchange office at New York to the Exchange office at Cape Town. Money orders to and from Natal and Zululand formerly were reissued at London. Payment may now be made on the original orders, provided the corresponding advices have been duly certified.

INTERNATIONAL REPLY-COUPONS.

International reply-coupons, of the denomination of 6 cents each, are issued for the purpose of sending to correspondents abroad. The foreign correspondent may exchange each coupon for postage stamps of the country in which he is located, equal in value to 5 cents in United States money, using the stamps for reply postage. The countries in which the reply-coupon is valid are as follows:

Argentine Republic.
Austria and the Austrian post offices in the Levant.
Belgium.
Bosnia-Herzegovina.
Brazil.
Bulgaria.
Chili.
Corea.
Costa Rica.
Crete.
Cuba.
Denmark, including Greenland and the Faroe Islands; the Danish West Indies.
Egypt.

France, the French post offices in China, Morocco, and Turkey; the French colonies of Algeria, Dahomey, Guadeloupe and dependencies, (Guiana (French), Indo-China, Ivory Coast, Martinique, Mauretania, New Caledonia, Oceanica, St. Pierre-Miquelon, Senegal, Senegal-Niger; French establishments in India.

Germany, the German protectorates and German post offices in Africa, Asia, Australasia, and Turkey.

Great Britain, British post offices in Morocco and Turkey; British colonies of Australia, Bahamas, Bechuanaland, Canada, Cape of Good Hope, Ceylon, Cook Islands, Dominica, East Africa, Gibraltar, Gold Coast, Honduras (British), Hong Kong and Hong Kong offices in China, India, Labuan, Malta, Mauritius Islands, Natal, Newfoundland, New Guinea, New Zealand, Papua, Seychelles, Sierra Leone, Somaliland, Southern Nigeria, South Rhodesia, Straits Settlements, Tasmania, Transvaal, Trinidad, Uganda, Zululand; British Protectorates of the Solomon, Gilbert and Ellice Islands.

Greece.
Haiti.
Honduras (Republic of).
Hungary.
Italy, and Italian colonies of Benadir and Erythrea.
Japan and Japanese post offices in China and Manchuria.
Liberia.
Luxemburg.
Mexico.
Netherlands, Netherlands Guiana, the Netherlands Indies.
Norway.
Portugal, including the Azores and Madeira.
Roumania.
Salvador.
Siam.
Spain.
Sweden.
Switzerland.
Tunis.
Turkey.

Persons who buy the reply coupons should inform their correspondents abroad that the reply coupon is not itself good for postage, but must be exchanged at the post office for a postage stamp. The postmark of the selling post office must be stamped legibly in the circle on the left-hand side of all reply coupons sold to the public.

DELIVERY AND FORWARDING OF REGISTERED MAIL

Either the sender or the addressee of domestic registered mail may restrict its delivery. Registered mail which is not restricted in delivery may be delivered to any responsible person who customarily receives the ordinary mail of the addressee.

Paragraph 1 of Section 869 of the Postal Laws and Regulations has been amended to read as follows:

"Sec. 869. All registered matter, except that which has once been properly delivered, may be forwarded without additional charge for registry fee, upon the written request of any person to whom it is deliverable. In cases of emergency, when the postmaster is satisfied that no fraud is intended, a telegraphic order from the addressee may be honored."

Written orders to forward mail, signed by addressees or their agents duly authorized to control such matter, must be construed to apply to both ordinary and registered mail, unless such orders specifically state that registered mail shall not be so forwarded, or separate and special written orders are furnished directing other disposition of registered mail.

REGISTRY RETURN RECEIPT TO BE FURNISHED ONLY WHEN REQUESTED BY THE SENDER.

Section 3928 of the Revised Statutes (855, P. L. & R.) has been amended to read as follows:

"Whenever the sender shall so request, a receipt shall be taken on the delivery of any registered mail matter, showing to whom and when the same was delivered, which receipt shall be returned to the sender and be received in the courts as prima facie evidence of such delivery."

In accordance with this amendment postmasters do not prepare receipt cards for return to the senders of domestic registered letters or parcels that do not bear the indorsement "Receipt desired" or words of similar import. When an article bearing such indorsement is received for registration, the registration receipt issued to the sender and the registration record are similarly indorsed.

REGISTRATION FEES.

The fee for the registration of all classes of mail matter, foreign and domestic, is fixed at 10 cents for each piece, in addition to postage, and both postage and fee must be prepaid at the time of registration.

The Department has prepared a distinctive registry stamp of 10-cent denomination, which will be recognized by postmasters and employees of the postal service for prepayment of the fee on registered matter, domestic or foreign; but ordinary postage stamps may still be used to prepay the registry fee when registry stamps are not available. The distinctive registry stamp of 10-cent denomination is to be used only in the prepayment of the registry fee on registered mail, domestic or foreign, and can be used for no other purpose. As the new registry stamp is not available for the payment of postage, the following instructions are issued for the treatment of mail upon which the sender has improperly affixed such stamps in an attempt to prepay the postage. When the distinctive registry stamp is not used the amount of ordinary postage stamps on any article should first be applied to the payment of postage and the balance, if any, to the payment of the registry fee. Both postage and registry fee should be fully prepaid before matter is presented for registration. Postmasters will decline to accept mail for registration bearing only distinctive registry stamps

or bearing such stamps and an insufficient amount in ordinary postage stamps to fully prepay postage.

INDEMNITY FOR REGISTERED MAIL.

Indemnity will be paid on account of the loss of registered mail in the postal service:

(a) For the value of domestic registered mail of the first class (sealed) up to $50.

(b) For the value of domestic registered mail of the third and fourth classes (unsealed) up to $25, mailed on or after July 1, 1911.

(c) In any amount claimed, within the limit of 50 francs (approximately $9.65), on account of the loss, in the international mails, of a registered article of any class, regardless of its value, exchanged between the United States and any country embraced within the Universal Postal Union, except on account of losses arising under circumstances beyond control ("force majeure") and international "Parcels Post" registered mail.

Postal employees are forbidden to address or seal envelopes to be registered.

First-class domestic matter must be sealed before being registered.

Registered mail for foreign countries must not be addressed with a lead pencil.

Articles intended for registration should be securely covered by envelopes or wrappers.

POSTAGE RATES ON ARTICLES FOR CANADA, CUBA, MEXICO, THE REPUBLIC OF PANAMA, THE UNITED STATES POSTAL AGENCY AT SHANGHAI AND THE UNITED STATES NAVAL HOSPITAL AT YOKOHAMA, JAPAN.

Articles addressed for delivery in Canada, Cuba, Mexico and the Republic of Panama are subject to the same postage rates and conditions which would apply to them if they were addressed for delivery in the United States: Except that:

(a) Letters and postal cards must be dispatched to Canada and Mexico if prepaid one full rate of postage and to Cuba and Panama whether prepaid or not. Other articles for Cuba and Panama must be prepaid at least in part and for Canada and Mexico in full.

(b) "Prints," "samples" and "commercial papers" may be sent subject to the postage rates, weight limit and other conditions applicable to similar articles in Postal Union mails.

(c) Plants, seeds, etc., mailed to Canada are subject to the postage rate of one cent an ounce.

(d) Articles other than letters in their usual and ordinary form are excluded from the mails, unless they are so wrapped that their contents can be easily examined by postmasters and customs officers. Any article enclosed in an envelope, as the word "envelope" is generally used, without regard to its size, is considered to be "in the usual and ordinary form" of a letter. But unsealed packages may contain, in sealed receptacles, articles which cannot be safely transmitted in unsealed receptacles, provided the contents of the closed receptacles are plainly visible or are precisely stated on the covers of the closed receptacles and that the package is so wrapped that the outer cover can be easily opened.

Unmailable.—The following articles are unmailable under any condition, viz.:

All sealed packages which, from their form and general appearance, evidently are not letters; publications which violate the copyright laws of the country of destination; poisons, explosive or inflammable substances; live or dead (not dried) animals, insects (except bees) and reptiles; fruits and vegetables which quickly decompose, and substances which exhale a bad odor; lottery tickets or circulars; all obscene or immoral articles. articles which may destroy or damage the mails, or injure the persons handling them; and to Cuba and the Republic of Panama, liquids and fatty substances, except samples thereof.

The domestic postage rates and conditions of Canada, Cuba, Mexico and the Republic of Panama apply to articles mailed in those countries addressed for delivery in the United States. Consequently articles (except sealed packages which are not letters) mailed in any one of those countries which are entitled to pass in the domestic mails of that country free of postage, are likewise entitled to transmission free of postage to the United States.

Prepayment of postage upon any article mailed in the United States, except the reply half of a double postal card, can be effected only by means of United States postage stamps.

Postage due: Postage due upon articles exchanged with these countries insufficiently prepaid, is collectible upon delivery at the single rate.

SECOND-CLASS MATTER FOR CANADA.

The postage rate applicable in the United States to "second-class matter" addressed for delivery in Canada is 1 cent for each 4 ounces or fraction of 4 ounces, calculated on the weight of each package and prepaid by means of postage stamps affixed; except that the postage rate to publishers and news agents applicable to legitimate daily newspapers issued as frequently as six times a week addressed to bona fide subscribers in Canada, is 1 cent a pound or fraction of a pound, to be paid at the office of mailing as second-class matter.

RATES OF POSTAGE ON ARTICLES FOR FOREIGN COUNTRIES OTHER THAN CANADA, CUBA, MEXICO, THE REPUBLIC OF PANAMA, THE UNITED STATES POSTAL AGENCY AT SHANGHAI AND THE UNITED STATES NAVAL HOSPITAL AT YOKOHAMA, JAPAN.

Articles for or from foreign countries (except Canada,* Cuba, Mexico and the Republic of Panama and the United States Postal Agency at Shanghai, as indicated above, are not designated "First-class matter," "Second-class matter," etc.; but are classified as "Letters," "Post cards," "Printed matter," "Commercial papers" and "Samples of merchandise," and are subject to the postage rates indicated below:

For letters, 5 cents for the first ounce, or fraction of an ounce, and 3 cents for each additional ounce, or fraction of an ounce. Stamps or forms of prepayment, whether current or obsolete, canceled or uncanceled, as well as printed articles constituting the representative sign of monetary value, and articles in typewriting or imitation of typewriting, are subject to postage at the letter rate. Monetary value is held by the International Bureau of the Universal Postal Union to attach to bonds, bank notes, commercial bills of exchange, etc., which have been fully executed by the makers:

For postal cards, 2 cents each, for single, and 4 cents each for double cards.

For printed matter of all kinds, 1 cent for each 2 ounces or fraction of 2 ounces.

For commercial papers, 5 cents for the first 10 ounces or less, and 1 cent for each additional 2 ounces or fraction of 2 ounces.

*Newfoundland is not included in the Dominion of Canada.

For samples, 2 cents for the first 4 ounces or less, and 1 cent for each additional 2 ounces or fraction of 2 ounces.

Registration fee, in addition to postage, 10 cents.

Letters for England, Ireland, Scotland, Wales and Newfoundland, 2 cents per ounce, and letters for Germany dispatched only by steamers which land the mails at German ports, 2 cents per ounce. Letters for Germany paid at the Postal Union rate will be dispatched by the fastest steamers and forwarded via Great Britain or France.

Letters and post cards must be dispatched even if no postage whatever is prepaid. Other articles must be prepaid at least in part. In all cases double the amount of the deficient postage is collectible of the addressee upon delivery.

GENERAL INFORMATION, REGULATIONS AND SUGGESTIONS.

There are minute directions and regulations regarding foreign mails, as follows: Prepayment, short payment, matter mailed at sea, withdrawing of mail, registration, reforwarding, merchandise, commercial papers, composite packages, prohibited articles and special prohibitions, which would occupy about 15 pages of this book. The reader is referred to the United States Official Postal Guide, which can be consulted at any post office or public library. These regulations are so minute that they are of little value when condensed and should be consulted in extenso.

DOMESTIC PARCELS POST.

The provisions of the act approved August 24, 1912, authorizing the establishment of the Parcels Post System embodying a zone system of postal rates according to certain prescribed distances from a given territorial center to take effect Jan. 1, 1913, provides that fourth-class mail matter is to embrace all other matter, including farm and factory products, not now embraced by law in either the first, second, or third-class, not exceeding eleven pounds in weight, nor greater in size than 72 inches in length and girth combined, nor in form or kind likely to injure the person of any postal employee or damage the mail equipment or other mail matter and not of a character perishable within a period reasonably required for transportation and delivery.

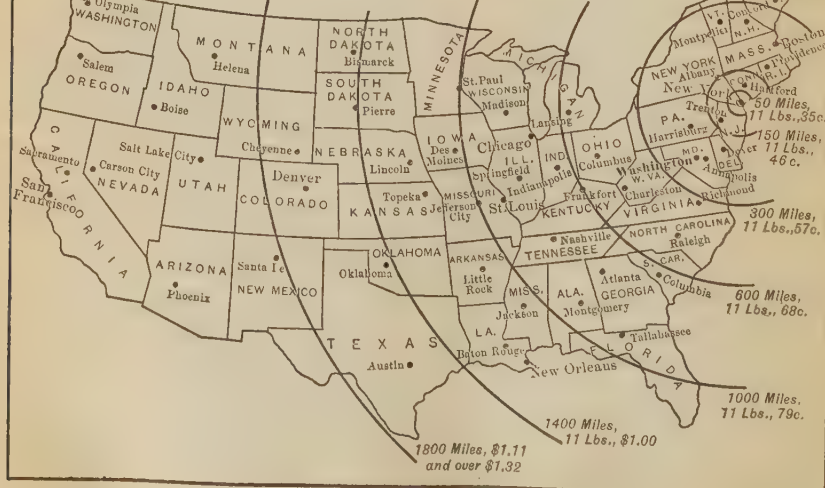
For parcels post purposes the United States and its several Territories and possessions, excepting the Philippine Islands, are divided into units of area thirty minutes square, identical with a quarter of the area formed by the intersecting parallels of latitude and meridians of longitude, represented on appropriate postal maps or plans, and these units of area are the basis of eight postal zones, as follows:

The first zone includes all territory representing an area having a mean radial distance of approximately 50 miles from the center of any given unit of area.

The second zone includes all units of area outside the first and lying within a radius of approximately 150 miles from the center of a given unit.

The third zone includes all units of area outside the second and lying within a radius of 300 miles from the center of a given unit.

(Continued on page 342.)



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RATE ZONES FOR DOMESTIC PARCELS POST.

APPROXIMATE TIME OF MAILS, AND DISTANCES BETWEEN NEW YORK AND CERTAIN PLACES IN FOREIGN COUNTRIES.

Name of place.	Days.	Statute miles.
via		
Accra (Africa).....London..	24	8,075
Addah (Africa).....London..	36	8,130
Adelaide (South Australia)...London..	38	15,315
Adelaide (South Australia).		
.....Vancouver..	31	12,845
Aden (Arabia).....London..	17	7,875
Akyab (British Burmah)....London..	33	11,670
Alexandria (Egypt).....London..	12	6,150
Algiers (Africa).....London..	9	5,030
Ambriz (Africa).....London..	35	9,785
Amsterdam (Netherlands)...London..	8	3,985
Antigua (Leeward Islands).....	8	1,790
Antwerp (Belgium).....London..	8	4,000
Arica (Peru).....Panama..	20	4,835
Aspinwall, see "Colon".		
Athens (Greece).....London..	11	5,655
Auckland (New Zealand).		
San Francisco..	28	10,120
Bahia (Brazil).....	14	5,870
Basle (Switzerland).....London..	9	4,420
Bangkok (Siam).....London..	41	13,125
Bangkok (Siam).....San Francisco..	43	12,900
Barbados (West Indies).....	6–8	2,145
Barcelona (Spain).....London..	9	4,790
Batavia (Java).....London..	34	12,800
Bathurst (Africa).....London..	22	6,705
Bayonne (France).....London..	10	4,510
Belize (British Honduras).		
New Orleans..	9	2,360
Berlin (Germany).....London..	8	4,385
Berne (Switzerland).....London..	9	4,490
Beirut (Syria).....London..	15	6,475
Bombay (British India).....London..	22	9,765
Bonny (Africa).....London..	42	8,590
Bordeaux (France).....London..	8	4,385
Bremen (Germany).....London..	7–8	4,235
Brindisi (Italy).....London..	10	5,205
Brisbane (Queensland, Australia).		
Vancouver..	28	12,190
Brussels (Belgium).....London..	7–8	3,975
Budapest (Hungary).....London..	9	4,910
Buenos Ayres (Argentine Republic)....	24	8,045
Bunder Abbas (Persian Gulf).London..	34	9,500
Bushire (Persian Gulf).....London..	30	9,950
Busreh (Persian Gulf).....London..	38	10,160
Cadiz (Spain).....London..	10	5,375
Cairo (Egypt).....London..	12	6,280
Calcutta (British India).....London..	24	11,120
Caldera (Chile).....Panama..	31	5,455
Callao (Peru).....Panama..	15	4,145
Cameroons (Africa).....London..	31	8,805
Cape Coast Castle (Africa)...London..	24	8,810
Cape Haitien (Haiti)	6	1,466
Cape Palmas (Africa).....London..	33	7,570
Cape Town (South Africa)...London..	25	11,245
Carril (Spain).....London..	12	5,545
Carthagena (Colombia).....Panama..	9	2,445
Cherbourg (France).....	6–8	3,780
Christiania (Norway).....London..	9	4,650
Cienfuegos.....Havana..	5	....
Ciudad Bolivar (Venezuela).....	11	2,715
Cobija (Bolivia).....Panama..	37	5,135
Cologne (Germany).....London..	8	4,115
Colon (Panama).....	6–7	2,281
Congo (Africa).....London..	28	9,605
Constantinople (Turkey)....London..	11	5,810
Copenhagen (Denmark).....London..	8–10	4,575
Coquimbo (Chile).....Panama..	21	5,685
Crete (Turkey).....London..	16	5,835
Curacao (West Indies).....	8	2,030
Cyprus (British).....London..	14	6,345
Delagoa Bay (Africa).....London..	30	11,520
Demerara (British Guiana).....	11	2,605
Dominica (Leeward Islands).....	12	1,920
Dresden (Germany).....London..	9	4,555
Falkland Islands.....	33	9,120
Faroe Islands.....London..	14	4,740
Fernando Po (Africa).....London..	45	8,745
Fiji Islands.....Vancouver..	24	8,855
Florence (Italy).....London..	9	4,800
Frankfort-on-Main (Germany).....		
London..	8–9	4,250

Name of place.	Days.	Statute miles.
via		
Gaboon (Africa).....London..	47	9,055
Geneva (Switzerland).....London..	8–9	4,410
Genoa (Italy).....London..	9	4,615
Gibraltar.....London..	11	5,150
Glasgow (Scotland).....London..	8	3,370
Gothenburg (Sweden).....London..	9	4,755
Goree (Africa).....London..	23	6,600
Granada (Spain).....London..	13	5,355
Grand Bassam (Africa).....London..	33	7,395
Grand Canary Island.....London..	13	5,695
Grenada (Windward Islands).....	9	2,325
Greytown (Nicaragua).New Orleans..	7	2,815
Guadeloupe (West Indies).....	11	1,865
Guatemala City (Guatemala).....		
New Orleans..	7	2,645
Guayaquil (Ecuador).....Panama..	14	3,295
Guaymas (Mexico).....R. R..	6	3,025
Hague (The Netherlands)..London..	9	3,950
Half Jack (Africa).....London..	31	7,670
Halifax (Nova Scotia).....	2	645
Hamburg (Germany).....Direct..	9	4,820
Hamburg (Germany).....London..	9	4,340
Hamilton (Bermuda).....	2	780
Havana (Cuba).....	3	1,366
Havre (France).....	8	3,940
Hong-Kong (China).....	27	10,590
Honolulu (Hawaii)...San Francisco..	12	5,645
Iceland.....London..	15	5,350
Inhambane (Africa).....London..	44	11,240
Interlaken (Switzerland)...London..	9	4,525
Iquique (Chile).....Panama..	18	4,965
Isles do Los (Africa).....London..	25	7,050
Jacmel (Haiti).....	7	1,910
Jeddah (Arabia).....London..	21	7,090
Kingston (Jamaica).....	5	1,820
Kurrachee (British India)..London..	23	10,330
Lagos (Africa).....London..	25	8,310
La Guayra (Venezuela).....	8–10	2,258
Lisbon (Portugal).....London..	10	5,335
Little Popo (Africa).....London..	38	8,185
Liverpool (England).....	7	3,540
Livingston (Guatemala).....		
New Orleans..	10	2,495
Loanda (Africa).....London..	28	9,855
London (England).....Plymouth..	7	3,740
London (England).....Fishguard..	6	3,760
Lucerne (Switzerland).....London..	9	4,480
Lyons (France).....London..	9	4,340
Maceio (Brazil).....	17	5,555
Madeira Island.....London..	12	5,345
Madras (British India).....London..	24	10,525
Madrid (Spain).....London..	9	4,925
Magdalena Bay (Mexico).....		
San Francisco..	10	4,375
Malaga (Spain).....London..	11	5,320
Malta Island.....London..	12	5,280
Maracaibo (Venezuela).....	11	2,280
Maranham (Brazil).....	16	3,805
Marseilles (France).....London..	9	4,560
Martinique (West Indies).....	9	1,980
Mauritius Island.....London..	35	12,350
Mayaguez (Porto Rico).....	7	1,830
Mazatlan (Mexico)...San Francisco..	10	4,795
Melbourne (Victoria, Australia).....		
Vancouver..	30	12,265
Mexico City (Mexico).....R. R..	5	3,750
Milan (Italy).....London..	9	4,615
Mollendo (Peru).....Panama..	20	4,655
Monrovia (Liberia, Africa)..London..	28	7,335
Montevideo (Uruguay).....	23	7,165
Moscow (Russia).....London..	11	5,535
Moulmein (British Burmah)..London.	36	12,020
Mozambique (Africa).....		
London and Brindisi..	33	10,470
Munich (Bavaria).....London..	9	4,610
Muscat (Muscat).....London..	35	9,230
Naples (Italy).....London..	9	5,195
Nassau (Bahamas).....	3	1,105
Natal (Africa).....London..	30	12,062
Nice (France).....London..	9	4,700
Nuremberg (Bavaria).....London..	9	4,395
Odessa (Russia).....London..	10	5,455

APPROXIMATE TIME AND DISTANCE — Continued.

Name of place.	Days.	Statute miles.
via		
Old Calabar (Africa).....London..	38	8,675
Oporto (Portugal).....London..	9	5,405
Pago Pago, (Samaon Islands).....		
San Francisco..	14	4,160
Panama (Panama).....Colon..	6	2,355
Papeete (Tahiti).....San Francisco..	17	4,212
Para (Brazil).....	12	3,460
Paris (France).....	8	4,020
Payta (Peru).....Panama..	15	3,545
Penang (Straits Settlements).....		
London..	38	11,733
Pernambuco (Brazil).....	16	5,425
Perth (West Australia).....	34	14,415
Point de Galle (Ceylon).....London..	29	10,405
Port au Prince (Haiti).....	7	1,600
Port Limon (Costa Rica).....		
New Orleans..	6	2,865
Puerto Cabello (Venezuela).....	10	2,160
Puerto Plata (San Domingo).....	7	1,570
Quebec (Canada).....	2	555
Queenstown (Ireland).....	6	3,250
Quilimane (Africa).....London..	38	10,840
Quitta (Africa).....London..	27	8,150
Rangoon (British India).....London..	26	11,900
Riga (Russia).....London..	11	5,190
Rio de Janeiro (Brazil).....	17	6,204
Rome (Italy).....London..	9	5,030
Rotterdam (Netherlands).....London..	8	3,935
Saigon (Cochin China).....London..	36	12,920
Saigon (Cochin China).San Francisco..	38	12,240
St. Helena Island.....London..	25	9,280
St. John's (Newfoundland).....	5	1,245
St. Kitts (Leeward Islands).....	8	1,800
St. Lucia (Windward Islands).....	9	2,025
St. Petersburg (Russia).....London..	9–10	5,370
St. Thomas (West Indies).....	6	1,650
St. Vincent (Cape de Verde Islands).....		
London..	18	6,625
St. Vincent (Windward Islands).....	11	2,245
Salt Pond (Africa).....London..	34	8,050
Samana (San Domingo).....	8	1,700
San Domingo City (San Domingo).....	9	1,920
San Juan (Porto Rico).....	6	1,730
Santa Marta (Colombia).....Panama..	13	2,310

Name of place.	Days.	Statute miles.
via		
Santander (Spain).....London..	10	4,875
Santiago (Chile).....Panama..	23	6,010
Santos (Brazil).....	19	6,980
Savanilla (Colombia).....	9	2,380
Senegal (Africa).....London..	27	6,505
Seychelles Islands (Indian Ocean).....		
London..	37	9,485
Shanghai (China).....London..	37	14,745
Shanghai (China).....Vancouver..	25	9,920
Sierra Leone (Africa).....London..	20	7,125
Singapore (Straits Settlements).....		
London..	30	12,175
Singapore (Straits Settlements).....		
San Francisco..	38	12,240
Southampton (England).....	7	3,680
Stockholm (Sweden).....London..	10	4,975
Strassburg (Germany).....London..	9	4,335
Stuttgart (Germany).....London..	10	4,460
Suez (Egypt).....London..	14	6,370
Sydney (New South Wales).....		
Vancouver..	29	11,570
Tampico (Mexico).....New Orleans..	7	2,250
Teneriffe (Canary Islands)..London..	14	5,645
Tiflis (Caucasus).....London..	18	6,630
Tours (France).....London..	10	4,165
Trieste (Austria).....London..	10	4,910
Trinidad (West Indies).....	8	2,370
Turin (Italy).....London..	9	4,520
Turk's Island (Bahamas).....	5	1,320
Valparaiso (Chile).....Panama..	22	5,915
Venice (Italy).....London..	9	4,780
Vera Cruz (Mexico).....R. R..	6	4,010
Vera Cruz (Mexico).....Steamer..	8	2,500
Vienna (Austria).....London..	9	4,740
Vigo (Spain).....London..	12	5,500
Wellington (New Zealand).....		
San Francisco..	27	10,490
Whydah (Africa).....London..	39	8,225
Winnebah (Africa).....London..	34	8,055
Yarmouth (Nova Scotia).....	1	518
Yokohama (Japan).....	20	7,345
Zanzibar (Africa).....London..	30	9,820
Zurich (Switzerland).....London..	9	4,175

THE "PARCELS POST."

Continued from page 340.)

The fourth zone includes all units of area outside the third and lying within a radius of 600 miles.

The fifth zone includes all units outside the fourth and lying within a radius of 1,000 miles.

The sixth zone includes all units outside the fifth and lying within a radius of 1,400 miles.

The seventh zone includes all units outside the sixth and lying within a radius of 1,800 miles.

The eighth zone includes all units of area outside the seventh zone.

There is a flat rate of one cent per ounce up to four ounces regardless of distance. Above four ounces, rates are by the pound or fraction thereof, and varying with the distance as given in the adjoining table.

It will be observed that a local and rural free delivery parcels post has been provided for to operate between various points on a rural route and a town Post Office, at a much lower rate, the highest charge being 15 cents for 11 pounds.

The Postmaster General provides such special equipment, maps, stamps, etc., as are necessary for the administration of the parcels post, including the hiring of teams and drivers and a special appropriation of $750,000 was made in the Post Office Appropriation Act for this purpose. The Postmaster General is required to make provision for the indemnification of shippers, for shipment injured or lost, by insurance or otherwise and he may, with the consent of the Interstate Commerce Commission after investigation, modify rates, weights, and zone distances, when experience has demonstrated the need thereof.

	First Pound.	Each Addit. Pound.	Eleven Pounds.
Rural route and city delivery	.05	.01	.15
50-mile zone	.05	.03	.35
150-mile zone	.06	.04	.46
300-mile zone	.07	.05	.57
600-mile zone	.08	.06	.68
1,000-mile zone	.09	.07	.79
1,400-mile zone	.10	.09	1.00
1,800-mile zone	.11	.10	1.11
Over 1,800 miles	.12	.12	1.32

For the purpose of a further inquiry into the subject of the parcels post a joint committee of six persons (Members of Congress) three of whom are appointed by the President of the Senate, and three by the Speaker of the House of Representatives was constituted and an appropriation of $25,000 was made for this purpose.

INTERNATIONAL PARCEL POST.

COUNTRIES TO WHICH PARCELS MAY BE SENT; MAXIMUM DIMENSIONS, WEIGHT, VALUE AND RATES OF POSTAGE APPLICABLE TO PARCELS; AND EXCHANGE POST OFFICES WHICH DISPATCH AND RECEIVE PARCEL POST MAILS.

Parcel-post parcels may also be mailed in Hawaii, Porto Rico, The Philippines, Guam, Tutuila and the Canal Zone, to the following countries and colonies with which the United States have parcel-post conventions, subject to the rules and regulations as are herein prescribed.

Names of countries.	Allowable dimensions and weight of parcels.				Postage rate.	Limit of value.	Exchange post offices.	
	Greatest length.	Greatest length and girth combined.	Greatest girth.	Greatest weight.			United States.	Foreign.
	Ft.	*Ft.*	*Ft.*	*Lbs.*				
Australia	3½	6	....	11		$80	San Francisco, Honolulu	Sydney, Melbourne, Brisbane, Adelaide, Perth, Hobart, Launceton.
Austria, including the Austrian offices in the Ottoman Empire at Alexandretta, Beyrout, Caifa Candia Canea, Cavalla, Chios, Dardanelles, Dedeagh, Durazzo, Ineboli Jaffa, Janina, Jerusalem, Kerassonda, Mersina, Mytilene, Prevesa, Retimo, Rhodes, Salonica, Samsoun, San Giovanni di Medua, Santi Quaranta, Scutari d'Albanie, Smyrna, Trebizond, Tripoli (Syria), Valona, Vathi (Samos).	3½	6	....	11		$80	New York, Chicago	Trieste.
Bahamas	3½	6	....	11		None.	do.	Nassau.
*Barbados	3½	6	....	11		None.	do.	Bridgetown.
Belgium	3½	6	....	11		$80	do.	Antwerp.
Bermuda	3½	6	....	11		None.	do.	Hamilton.
Bolivia	3½	6	....	11		None.	New York and San Francisco.	La Paz.
Brazil	3½	6	....	11		None.	New York.	Bahia, Para, Pernambuco, Rio de Janairo and Sao Paulo.
British Guiana	3½	6	....	11		None.	All offices authorized to exchange mails between the two countries.	
Chile	3½	6	....	11		None.	New York, San Francisco	Valparaiso.
Colombia	2	.	4	11		None.	All offices authorized to exchange mails between the two countries.	
Costa Rica	3½	6	....	11		None.	Do.	
*Curacao (including Aruba, Bonaire, Saba, St. Eustatius and the Dutch part of St. Martins).	3½	6	....	11		None.	New York	Wilhemstad.
Danish West Indies (St. Croix, St. John and St. Thomas).	3½	6	....	11		None.	Do.	
Denmark (including Faroe Islands and Iceland).	3½	6	....	11		$80	New York, Boston, Chicago	Copenhagen.
Ecuador	3½	6	....	11		$50	New York, New Orleans, San Francisco	Guayaquil.
*Dutch Guiana	3½	6	....	11		None.	New York	Paramaribo.
*France (Excluding Algeria and Corsica)	3½	6	....	11		$80	New York	Cherbourg and Havre.
Germany (including Cameroon, Togo, German East Africa, German South-west Africa, Protectorate of Kiowchow and certain German post offices in China).	3½	6	....	11		None.	New York, Chicago, Boston, St. Louis, Philadelphia, Baltimore	Hamburg. Bremen.
*Great Britain, including Ireland	3½	6	....	11		None.	New York, Chicago, Boston, Philadelphia, St. Louis, Baltimore, San Francisco	London. Liverpool. Dublin.
Guatemala	3½	6	....	11		None.	New York, New Orleans, San Francisco	Guatemala City. Retalhuleu and Puerto Barrios
Haiti	3½	6	....	11		None.	New York	Port au Prince
Honduras (British)	3½	6	....	11		None.	New Orleans	Belize.
Honduras (Republic of)	3½	6	....	11		None.	New York, New Orleans, San Francisco	Tegucigalpa. Puerto Cortez. Amapala. Trujillo.

12 cents a pound or fraction of a pound to all countries.

* Parcels cannot be registered.

COUNTRIES TO WHICH PARCELS MAY BE SENT; MAXIMUM DIMENSIONS, WEIGHT, VALUE AND RATES OF POSTAGE APPLICABLE TO PARCELS; AND EXCHANGE POST OFFICES WHICH DISPATCH AND RECEIVE PARCEL POST MAILS—Continued.

Names of countries.	Allowable dimensions and weight of parcels.				Postage rate.	Limit of value.	Exchange post offices.	
	Greatest length.	Greatest length and girth combined.	Greatest girth.	Greatest weight.			United States.	Foreign.
	Ft.	*Ft.*	*Ft.*	*Lbs.*				
Hong-Kong. See section 107 below...	3½	6	....	11		$80	San Francisco, Seattle, Tacoma, Honolulu	Hong-Kong.
Hungary	3½	6	....	11		$80	New York, Chicago	Fiume.
Italy, (including Rep. of San Marino, Italian Colonies of Benadir and Erythrea, and the Italian offices in the Ottoman Empire at Bengazi (North Africa), Durazzo (Albania), Galata (Constantinople), Jerusalem (Palestine), Canea (Crete), Pera (Constantinople), Salonica (Roumelia), Scutari (Asia Minor), Smyrna (Asia Minor), Stamboul (Constantinople), Tripoli-in-Barbary, Valona (Albania).	3½	6	....	11		$80	Philadelphia, Chicago, New York, Boston	Naples.
Jamaica, including the Turks and Caicos Islands.	3½	6	...	11		None.	Boston, Philadelphia, Baltimore	Port Antonio.
Japan, including Formosa, Karafuto (Japanese Saghalien) and Korea. See section 107 below.	3½	6	....	11		$80	San Francisco, Seattle, Tacoma, Honolulu	Yokohama. Kobe. Nagasaki.
Leeward Islands (Antigua with Barbuda and Redonda, St. Kitts, Nevis with Anguilla, Dominica, Montserrat and the Virgin Islands).	3½	6	....	11		None.	New York	St. John. Antigua.
Mexico	2	.....	4	†		None.	All offices authorized to exchange mails between the two countries.	
*Netherlands	3½	6	....	11		$80	New York	Rotterdam.
Newfoundland	3½	6	....	11		None.	New York, Boston, Philadelphia	St. John's.
New Zealand, including Fanning Island	3½	6	....	11		None.	San Francisco, Honolulu	Auckland.
Nicaragua	3½	6	....	11	12 cents a pound or fraction of a pound to all countries.	None.	New York New Orleans San Francisco	Bluefields. San Juan del Norte. Corinto.
Norway	3½	6	....	11		$80	New York, Boston, Chicago	Christiania.
Panama	3½	6	....	11		None.	New York, New Orleans, San Francisco	Colon, Bocas del Toro.
Peru	3½	6	....	11		None.	New York, New Orleans, San Francisco	Lima.
Salvador	3½	6	....	11		None	New York, San Francisco	San Salvador.
Sweden	3½	6	....	11		$80	New York, Boston, Chicago	Malmo.
Trinidad, including Tobago	3½	6	....	11		None.	New York	Port of Spain.
*Uruguay	3½	6	....	11		None.	New York	Montevideo.
Venezuela	3½	6	....	11		None.	All offices authorized to exchange mails between the two countries.	
Windward Islands (Grenada, St. Vincent, the Grenadines and St. Lucia).	3½	6	....	11		None.	do.	

POST OFFICE DEPARTMENT.

The Postmaster General is the executive head of the Federal postal service. He appoints all officers and employees of the Post Office Department except the four Assistant Postmasters General and the Purchasing Agent, who are Presidential appointees. With the exception of postmasters of the first, second, and third classes, who are likewise Presidential appointees, he appoints all postmasters and all other officers and employees of the service at large. Subject to the approval of the President, he makes postal treaties with foreign governments. He awards and executes contracts and directs the management of the foreign mail service.

INTERNATIONAL PARCELS POST.

Additional parcels post conventions have been concluded during the year with Brazil, effective May 29, 1911, and with Hayti, effective May 1, 1911. Negotiations for the convention with Brazil had been pending since 1887. Both conventions are similar as to rates of postage and weight limits, etc., to all the conventions with South American countries. The negotiations with the Union of South Africa were unsuccessful, as, for the time being, have been those with Argentina and Santo Domingo. Arrangements have been made with Italy and Austria in connection with the parcels post conventions with those countries whereby parcels can also be sent, without additional cost, to the Italian and Austrian post offices in the Ottoman Empire, which includes Constantinople, Jerusalem, Tripoli, Salonica, and other Levantine commercial centers, and to the Italian possessions of Erythrea and Benadir in the Red Sea and the Indian Ocean. An arrangement with France raising the weight limit from 2 kilograms (4 pounds 6 ounces) to 5 kilograms (11 pounds), and the value limit from $50 to $80, effective July 1, 1911, now makes the service essentially uniform as to limit of value and entirely uniform as to limit of weight. The increase in the number and weight of parcels sent to foreign countries is a clear indication of the advantages which it offers to American exporters who have no other cheap and convenient means of conveying commodities of small bulk to foreign ports.

We now have parcels post conventions with 43 foreign countries. The following are the general characteristics of the service to-day:

Postage rate, 12 cents per pound.

Limit of weight, 11 pounds.

Limit of value, none (except to Europe, Japan, Australia and Hongkong, which is $80, and Ecuador, $50).

Limits of size, 3 feet 6 inches, greatest length; 6 feet, greatest combined length and girth (except to Mexico and Colombia, which is 2 feet greatest length and 4 feet greatest girth).

The weight of the parcels post mails dispatched from the United States during the year was 1,824,623 pounds, an increase over the previous year of 333,905 pounds, or 22.4 per cent. The number of parcels dispatched was 615,260, of an average weight of 2.96 pounds, an increase in number of 93,774, or 18 per cent. The weight of the parcels post mails received was 1,680,724 pounds, an increase of 234,367 pounds, or 16.2 per cent. The number of parcels received was 359,219, of an average weight of 4.68 pounds, an increase in number of 53,574, or 17.5 per cent.

The fact that the percentages of increase in the number, total weights and average weights are greater as regards the parcels sent from this country than as regards those received from abroad is gratifying. The growth of the service is more largely due to the increased use of it by American exporters than to importations of foreign commodities.

INFORMATION FOR SHIPPERS.

Admissible Articles.—Any article absolutely prohibited admission to the regular mails for any country is also inadmissible to Parcel Post mails for that country; but no article is excluded from Parcel Post mails solely because it is dutiable in the country of destination.

How to Mail Parcels.—A parcel must not be posted in a letter-box, but must be handed to the postmaster or other official in charge of the post office.

Address, etc.—Every parcel must bear a complete and legible address, not written in pencil, and marked conspicuously "Parcel Post."

Packing.—Every parcel must be securely and substantially packed; but in such a way that it can be opened without damaging its cover, in order that its contents may be easily examined by postmasters and customs officials.

Postage.—Postage on every parcel must be fully prepaid at the rate applicable thereto as indicated in the tables on pages 343-344.

Letters Must Not Accompany Parcels.—A communication of the nature of personal correspondence must not accompany or be written on any parcel but an open bill or invoice may be included. If such written matter be found it will be placed in the mails if separable, and if inseparable the entire parcel must be rejected.

Separately Addressed Packages.—Parcels must not contain packages addressed to persons other than the person named on the outside address of the parcel itself. If such enclosed packages be detected they must be sent forward singly charged with new and distinct parcel post rates.

No Responsibility for Loss.—The Department is not responsible for the loss of or damage to any parcel.

Registration.—The sender of a parcel addressed to any of the places indicated in the foregoing table, except Barbados, Dutch Guiana, France, Great Britain, The Netherlands and Uruguay may have the parcel registered by paying a registration fee of 10 cents, and will receive the "return receipt" without additional charge therefor, provided he demands a return receipt when he mails the parcel.

Undeliverable Parcels Returned to United States.—An undeliverable parcel returned to the United States, upon which the return postage has not been prepaid, is subject on delivery to the sender to a postage charge equal to the amount of postage originally prepaid on the parcel; which amount should be marked on the parcel by the United States exchange post office which receives it back from abroad, and collected by the post office which delivers it to the sender.

Customs Declarations.—A "customs declaration" properly filled out must be securely attached to every parcel. The contents must be accurately described. General terms such as "merchandise" and "samples" will not answer.

Customs Duties.—Customs duties cannot be prepaid; they will be collected of addressees when the parcels are delivered.

THE POSTAL SAVINGS SYSTEM.

The Director of the Postal Savings System, under the direction of the Postmaster General, has general supervision over postal savings depositories, the conduct of the postal savings business at post offices, the correspondence and records of the department pertaining to the postal savings system, and the administrative examination of the postal savings accounts of postmasters and other agents accountable to the Postmaster General.

RATES OF POSTAGE IN CERTAIN FOREIGN COUNTRIES ON ARTICLES SENT TO THE UNITED STATES.

[5 centimes, French currency, are the equivalent of 1 cent, United States money.]

Countries.	Letter rate for the first weight-unit.		For each additional unit.	Single postal cards, each.*		Other articles, per 50 grams, equal to 2 oz.		Charge for registration.	Charge for return-receipt.
	Currency of country.	Centimes.	Currency of country.	Currency of country.	Centimes.	Currency of country.	Centimes.		
Antigua	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Argentine Republic	12 centavos	23	12 centavos (2)	5 centavos	10	3 centavos	5	12 centavos	12 centavos.
Ascension	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Australia	do	25	2½ pence (3)	1 penny	15	1 penny	10	3 pence	Do.
Austria	25 heller	25	15 heller (2)	10 heller	10	5 heller	5	25 heller	25 heller.
Bahamas	1 penny	10	1 penny (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Barbados	2½ pence	25	1½ pence (1)	do	10	do	5	do	Do.
Bechuanaland Protectorate	do	25	2½ pence (3)	do	10	do	5	4 pence	Do.
Belgium	25 centimes		15 centimes (2)	10 centimes		5 centimes		25 centimes	25 centimes.
Bermuda	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Bolivia, via Panama	22 centavos	55	14 centavos (2)	8 centavos	20	6 centavos	15		
Bolivia, via San Francisco	20 centavos	50	12 centavos (2)	6 centavos	15	4 centavos	10	10 centavos	10 centavos.
Bosnia-Herzegovina	25 heller	25	15 heller (2)	10 heller	10	5 heller	5	25 heller	25 heller.
Brazil	200 reis	30	200 reis (3)	100 reis	12½	50 reis*¶	6½	400 reis	200 reis.
Bulgaria	25 stotinki	25	15 stotinki (2)	10 stotinki	10	5 stotinki	5	25 stotinki	25 stotinki.
Canada	2 cents per oz	10		1 cent	5	Canadian domestic rates.		5 cents	5 cents.
Cayman Islands	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Cape Colony†	do	25	2½ pence (3)	do	10	½ penny	5	4 pence	Do.
Ceylon	15 cts. of rupee	25	9 centimes (1)	6 cts. of rupee	10	3 cts. of rupee	5	10 cts. of rupee	10 cts. of rupee.
Chile	20 centavos	25	10 centavos (2)	8 centavos	10	4 centavos	5	20 centavos	20 centavos.
China, Empire of, also foreign offices in.	10 cents	25	6 cents (2)	4 cents		2 cents		10 cents	10 cents.
Colombia, Republic of	5 gold centavos	25	5 centavos (3)	2 gold centavos	10	1 gold centavo	5	10 gold centavos	5 gold centavos.
Congo, Independent State of	25 centimes		25 centimes (3)	10 centimes	10	5 centimes	5	25 centimes	10 centimes.
Costa Rica	10 centimos	25	10 centimos (3)	4 centimos	10	2 centimos	5	10 centimos	5 centimos.
Crete	25 lepta, 20 gms	25	15 lepta, 15 gms	10 lepta	10	5 lepta	5	25 lepta	20 lepta
Cuba‡	2 centavos (1)	10	2 centavos (1)	1 centavo	5	1 centavo	5	8 centavos	
Cyprus	2 piastres	25	1½ piastres (1)	1 piastre	10	½ piastre	5	2 piastres	2 piastres.
Danish West Indies	25 bit	25	15 bit (2)	10 bit	10	5 bit	5	25 bit	15 bit.
Denmark	20 ore	25	10 ore (2)	10 ore	10	5 ore	5	15 ore	10 ore.
Dominican Republic (direct)	5 centavos	25	5 centavos (3)	2 centavos	10	2 centavos	5	5 centavos	5 centavos.
Dominica	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
East Africa, British	15 cents	25	9 cents (1)	6 cents	10	3 cents	5	12 cents	12 cents.
Ecuador	10 centavos	50	10 centavos (3)	3 centavos	15	1 centavo	5	10 centavos	5 centavos.
Egypt	10 milliemes	25	6 milliemes (2)	4 milliemes de livre	10	2 milliemes de livre	5	10 milliemes de livre	10 milliemes de livre.
Ethiopia	2 guerches	25	1 guerche (2)	½ guerche	10	½ guerche	5	2 guerches	½ guerche
Falkland Islands	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Fiji Islands	do	25	do	do	10	do	5	3 pence	Do.
France and Colonies	25 centimes		15 centimes (2)	10 centimes		5 centimes		25 centimes	10 centimes.
Gambia	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.

Germany**	20 pfennig		10 pfennig (2)	10 pfennig	10	5 pfennig	5	20 pfennig	20 pfennig.
German Protectorates, viz.:									
Cameroons (or Kameron) Togo. German South West Africa, in *Africa*	do	25	do	do	10	do	5	do	do.
Caroline and Palaos Islands, Mariana Islands, Marshall Islands, New Guinea and Samoa, in the Pacific									
Gilbert and Ellice Islands	2½ pence	25	2½ pence (1)	1½ pence	15	1 penny §§	10	3 pence	2½ pence.
Kiautschau, in China	10 cents (Mex.)	25	6 cents (2)	4 cents (Mex.)	10	2 cents (Mex.)	5	10 cents (Mex.)	10 cents (Mex.).
German East Africa	15 heller	25	7½ heller (2)	7½ heller	10	4 heller	5	15 heller	15 heller.
Gibraltar	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Gold Coast	do	25	do	do	10	do	5	do	do.
Great Britain	1 penny	10	1 penny (1)	do	10	do	5	do	do.
Greece	25 lepta	25	25 lepta (3)	10 lepta	10	5 lepta	5	25 lepta	20 lepta.
Greenland	20 ore	25	10 ore (2)	10 ore	10	5 ore	5	15 ore	10 ore.
Grenada	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Guam, Island of§									
Guatemala	50 centavos	50	50 centavos (3)	15 centavos	15	10 centavos	10	50 centavos	25 centavos.
Guiana, British	5 cents	25	3 cents (1)	2 cents	10	1 cent	5	4 cents	4 cents.
Guiana, Dutch	12½ cents Dutch	25	7½ cents (2)	5 cents Dutch	10	2½ cents Dutch	5	10 cents Dutch	10 cents Dutch.
Hawaii§									
Haiti	5 centavos	25	5 centavos (3)	2 centavos	10	1 centavo	5	5 centavos	3 centavos.
Honduras, Republic of	15 centavos	37½	11 centavos (2)	5 centavos	12½	3 centavos	7½	10 centavos	5 centavos.
Honduras, British	5 cents	25	3 cents (1)	2 cents	10	1 cent	5	5 cents	5 cents.
Hong-Kong	10 cents	25	6 cents (1)	4 cents	10	2 cents	5	10 cents	10 cents.
Hungary	25 filler	25	15 filler (2)	10 filler	10	5 filler	5	25 filler	25 filler.
India, British	2½ annas	25	1½ annas (1)	1 anna	10	½ anna or 6 pies	5	2 annas	1 anna.
Italy and Colony of Eritrea	25 centesimi	25	25 centesimi (3)	10 centesimi	10	5 centesimi	5	25 centesimi	25 centesimi.
Italian Protectorate of Benadir	2½ annas	25	2½ annas (3)	1 anna	10	2 besas	5	2½ annas	2½ annas.
Jamaica	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2 pence.
Japan	10 sen	25	6 sen (2)	4 sen	10	2 sen	5	10 sen	5 sen.
Korea	do	25	do (2)	do	10	do	5	do	do.
Labaun	8 cents	25	5 cents (1)	3 cents	10	1 cent	5	10 cents	8 cents.
Lagos	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Liberia	5 cents	25	5 cents (3)	3 cents	15	1 cent	5	10 cents	5 cents.
Luxemburg	25 centimes		15 centimes (2)	10 centimes		5 centimes		25 centimes	25 centimes.
Malta	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Mauritius	15 cts. of rupee	25	9 cts. (1)	6 cts. of rupee	10	3 cts. of rupee	5	12 cts. of rupee	15 cts. of rupee.
Mexico	5 centavos	12½	5 centavos (2)	2 centavos	10	1 centavo	5	10 centavos	5 centavos.
Montenegro	25 paras	25	25 paras (3)	10 paras	10	5 paras	5	25 paras	25 paras.
Montserrat	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Mozambique	50 reis	25	50 reis (3)	20 reis	10	10 reis	5	50 reis	50 reis.
Natal	2½ pence	25	2½ pence (3)	1 penny	10	½ penny	5	4 pence	2½ pence.
Netherlands	12½ cts. Dutch	25	7½ cents (2)	5 cents Dutch	10	2½ cts. Dutch	5	10 cts. Dutch	10 cts. Dutch.

In the countries and colonies marked (1) the weight-unit is one ounce. In countries and colonies marked (2) the weight-unit is twenty grams or about ¾ ounce. In countries and colonies marked (3) the weight-unit is fifteen grams or about ½ ounce.

* The rate for a reply-paid (double) card is double the rate named in this column.

† Cape Colony comprises, besides the colony proper, Griqualand, Little Namaqualand, St. John's River Territory, Tembuland, Transkei, Walfish Bay, Basutoland, Bechuanaland and Pondoland.

‡ Cuban domestic postage rates and conditions.

§ U. S. domestic postage rates and conditions.

§§ ½ penny for newspapers.

** Letters from Germany by steamers sailing from Germany direct, per each 20 grams, 10 pfennig.

*¶ 80 reis for commercial papers and samples of merchandise.

RATES OF POSTAGE IN CERTAIN FOREIGN COUNTRIES ON ARTICLES SENT TO THE UNITED STATES.—Continued.

[5 centimes, French currency, are the equivalent of 1 cent, United States money.]

Countries.	Letter rate for the first weight-unit.		For each additional unit.	Single postal cards, each.*		Other articles, per 50 grams, equal to 2 oz.		Charge for registration.	Charge for return-receipt.
	Currency of country.	Centimes.	Currency of country.	Currency of country.	Centimes.	Currency of country.	Centimes.		
Netherlands, East Indies	12½ cents Dutch	25	7½ cents (2)	5 cents Dutch	10	2½ cents Dutch	5	10 cents Dutch	10 cents Dutch.
Netherlands, West Indies	do	25	do	do	10	do	5	do	do.
Nevis	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Newfoundland	2 cents	10	2 cents (1)	2 cents	10	1 cent	5	5 cents	5 cents.
New Guinea, British	2½ pence	25	2½ pence (3)	1 penny	10	1 penny	10	3 pence	2½ pence.
New Hebrides	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2½ pence	1 penny.
New Zealand, with Cook's Islands	1 penny	10	1 penny (1)	1 penny	10	½ penny	5	do	2½ pence.
Nicaragua	50 centavos	50	35 centavos (2)	15 centavos	15	10 centavos	10	50 centavos	25 centavos.
Nigeria, Southern	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
North Borneo, British	10 cents	25	10 cents (3)	4 cents	10	2 cents	5	10 cents	6 cents.
North West Rhodesia, British Protectorate	4 pence	40	4 pence (3)	1 penny	10	1 penny	10	4 pence	2½ pence.
Norway	20 ore	25	10 ore (2)	10 ore	10	5 ore	5	20 ore	20 ore.
Nyassaland, British Protectorate	3 pence	30	3 pence (3)	2 pence	20	2 pence	20	4 pence	2 pence.
North East Rhodesia, British Protectorate	2½ do	25	2½ pence (3)	1 penny	10	do	20	do	2½ pence.
Orange River Colony	do		do (3)	do		½ penny	5	do	do.
Panama	2½ centesimos (silver)	12½	2 centesimos (2)	1 centesimo	5	1 centesimo	5	5 centesimos	2½ centesimos.
Paraguay	75 centavos	37½	75 centavos (3)	25 centavos	12½	15 centavos	7½	50 centavos	50 centavos.
Persia	13 shahis	25	13 shahis (3)	6 shahis	10	3 shahis	5	13 shahis	13 shahis.
Peru, via San Francisco	10 centavos	25	10 centavos (3)	4 centavos	10	4 centavos	10	10 centavos	10 centavos.
Peru, via Panama	12 centavos	30	12 centavos (3)	do	10	6 centavos	15		
Philippine Islands†									
Porto Rico†	Same as U. S.								
Portugal, including the Azores and Madeira Islands	50 reis	25	30 reis (2)	20 reis	10	10 reis	5	50 reis	50 reis.
Portuguese Colonies:									
Angola									
Cape Verde									
Guinea	do	25	(2)	do	10	do	5	do	do.
St. Thome and Princes									
Portuguese India	2 tangas	25	15 reis (2)	10 reis	10	5 reis	5	2 tangas	2 tangas.
Macao	10 avos	25	6 avos (2)	4 avos	10	2 avos	5	10 avos	10 avos.
Timor	do	25	do (2)	do	10	do	5	do	do.
Rhodesia, Southern	2½ pence	25	2½ pence	1 penny	10	½ penny	5	4 pence	2½ pence
Roumania	25 bani	25	15 bani (2)	10 bani	10	5 bani	5	25 bani	25 bani
Russia	10 kopecks	25	10 kopecks (3)	4 kopecks	10	2 kopecks	5	10 kopecks	10 kopecks.
Russian postoffices in Turkey	40 paras	25	30 paras (2)	20 paras		10 paras		40 paras	40 paras
Salvador	17 centavos (2)	35	12 centavos	5 centavos	10	2 centavos	10	20 centavos	5 centavos
Sarawak, British Protectorate of	10 cents	25	6 cents (1)	4 cents	10	2 cents	5	8 cents	10 cents

Servia	25 paras	25	15 paras (2)	10 paras	10	5 paras	5	25 paras	25 paras.
Seychelles	15 cts. of rupee	25	9 centiemes (1)	6 centiemes	10	3 cts. of rupee	5	12 cts. of rupee	15 cts. of rupee.
Siam	14 satangs	25	14 satangs (3)	6 satangs	10	3 satangs	5	14 satangs	14 satangs.
Sierra Leone	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Solomon & Shortland Islands	2½ pence	25	2½ pence (1)	1½ pence	15	1 penny (z)	10	3 pence	2½ pence.
Somaliland, British	2½ annas	25	1½ annas (1)	1 anna	10	½ anna	5	2 annas	2 annas.
Spain	25 centimos	25	15 centimos (2)	10 centimos	10	5 centimos	5	25 centimos	10 centimos.
St. Christopher (St. Kitts)	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
St. Helena	do.	25	do.	do.	10	do.	5	do.	do.
St. Lucia	do.	25	do.	do.	10	do.	5	do.	do.
St. Vincent	do.	25	do.	do.	10	do.	5	do.	do.
Straits Settlements and Labuan	8 cents	25	5 cents (1)	3 cents	10	1 cent	5	10 cents	8 cents.
Sweden	20 ore	25	10 ore (2)	10 ore	10	5 ore	5	15 ore	10 ore.
Switzerland	25 centimes		15 centimes (2)	10 centimes		5 centimes		25 centimes	25 centimes.
Tasmania	2½ pence	25	2½ pence (3)	1 penny	10	½ penny	5	3 pence	2½ pence.
Tobago	do.	25	1½ pence	do.	10	do.	5	2 pence	do.
The Transvaal	do.	25	2½ pence (3)	do.	10	do.	5	4 pence	do.
Trinidad	do.	25	1½ pence (1)	do.	10	do.	5	2 pence	do.
Tunis	25 centimes	25	15 centimes (3)	10 centimes	10	5 centimes	5	25 centimes	10 centimes.
Turkey	40 paras	25	30 paras (2)	20 paras	10	10 paras	5	40 paras	40 paras.
Turk's Island	2½ pence	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	2½ pence.
Uruguay	8 centesimos	40	8 centesimos (2)	2 centesimos	10	1 centesimo	10	10 centesimos	5 centesimos.
Venezuela	50 centiemes	50	25 centiemes (2)	15 centiemes	15	10 centiemes	10	50 centiemes	25 centiemes.
Virgin Isles	do.	25	1½ pence (1)	1 penny	10	½ penny	5	2 pence	do.
Zanzibar, British Protectorate	15 hundredths of a rupee	25	9 hundredths of a rupee (1)	6 hundredths of a rupee	10	3 hundredths of a rupee	5	12 hundredths of a rupee	12 hundredths of a rupee.
Zululand	2½ pence	25	2½ pence (3)	1 penny	10	½ penny	5	4 pence	2½ pence.

In the countries and colonies marked (1) the weight-unit is one ounce. In countries and colonies marked (2) the weight-unit is twenty grams or about ¾ ounce. In countries and colonies marked (3) the weight-unit is fifteen grams or about ½ ounce.

* The rate for a reply-paid (double) card is double the rate named in this column.

† U. S. domestic postage rates and conditions.

3½ pence for newspapers.

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From left to right: Woolworth Bldg., Hudson Terminal Bldg., City Investing Bldg., Singer Bldg., Bankers' Trust Bldg., Whitehall Bldg., Tower of Old Produce Exchange Bldg.

A WONDER OF THE MODERN WORLD.

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THE WOOLWORTH BUILDING.

Highest Office Building in the World. 51 stories; 750 feet above sidewalk level.

CHAPTER XIII.

PATENTS, TRADE-MARKS, AND COPYRIGHTS.*

Revised by Loyd H. Sutton, of the United States Patent Office.

GENERAL INFORMATION REGARDING PATENTS.

WHAT IS A PATENT?—The term *patent* or *letters patent* is derived from *litterae patentes*, signifying that which is open or disclosed, in contradistinction to *lettre de cachet*, that which is sealed or secret. This term is the keynote of the whole principle upon which the patent system is built up, namely, disclosure. The disclosure must be honest, absolute and unreserved. The penalty for mental crookedness or for ignorance in giving out fully and freely the nature of the invention is severe and direct, and is nothing less than forfeiture of the patent itself. The reason for this is perfectly logical and arises from the very meaning, spirit and nature of the relationship existing between the patentee and the government. The term of a patent is 17 years. During this term of 17 years the patentee obtains a monopoly under which he secures exclusive right of manufacture, use and sale. The patent itself, however, is in the nature of a contract between the patentee and the government, presumably for their mutual benefit. The government grants to the inventor the exclusive right of manufacture and sale for 17 years on condition that the inventor shall disclose fully the nature of his invention or discovery, and shall allow the public the unrestricted use of the invention after this term has expired. If he fail in making full disclosure, he has not lived up to the terms of the implied contract and the patent thereby becomes null and void. It sometimes happens that an inventor discloses freely part of the invention, but cunningly conceals some essential step in the process, but if the case is tested within the courts and the real facts are brought to light, the patent will be declared invalid. At the end of the term of 17 years the patent becomes public property, and the article may be freely manufactured by any one. It can never thereafter, as in so many cases in the Middle Ages, become a lost art.

WHO MAY OBTAIN A PATENT?—In order to secure a valid patent, the applicant must declare upon oath that he believes himself to be the original and first inventor or discoverer of the art, machine, manufacture, composition or improvement for which he solicits a patent; that he does not know and does not believe that the same was ever before known or used; that the invention has not been in public use or on sale in the United States for more than two years before the application was filed, and not described in any printed publication or patent in this or any foreign country for more than two years prior to the filing of his application; and that the invention has not been patented to himself or to others with his knowledge or consent in this or any foreign country for more than two years prior to his application, or on an application for a patent filed in any foreign country by himself or his legal representatives or assigns more than twelve months prior to his application. Any one who can subscribe to the above conditions may apply for a patent, irrespective of race, color, age or nationality. Minors and women and even convicts may apply for patents under our law. The rights even of a dead man in an invention are not lost, for an application may be filed in his name by his executor or administrator, and the rights of his heirs thereby safeguarded. The patent in this case would issue to the executor or administrator and would become subject to the administration of the estate like any other property left by the de-

* Compiled originally for Munn & Co., Patent Attorneys.

ceased. Even the rights of an insane person may not be lost, as the application may be filed by his legal guardian. If foreign patents for the same invention have been previously issued, having been filed more than twelve months before the filing of the United States application, the patent will be refused. The applicant must state his nationality. It often happens that two or more individuals have jointly worked upon the invention, and in this case the several inventors should jointly apply for the patent. Should they not so apply, the patent when issued will be invalid. If they are merely partners, however, and not co-inventors, they should not apply jointly for a patent, as the inventor alone is entitled to file the application. He may, however, assign a share in the patent to his partner, coupled with the request that the patent should issue to them jointly. It is of the greatest importance that these distinctions should be clearly understood; otherwise, the patent may be rendered invalid.

WHAT MAY BE PATENTED?—Any *new and useful* art, machine, manufacture or composition of matter, or any new and useful improvements thereon. The thing invented must be *new and useful*. These are conditions precedent to the granting of a patent. Of these two conditions by far the more important is the former, and it is concerning the interpretation of this word "*new*" and its bearing upon the invention that the principal work and labor involved in passing an application safely through the Patent Office is involved. When the invention has been worked out by the inventor and he is prepared to file his application, he or his attorney prepares the necessary papers as provided for by law, namely: An Oath, a Petition, a Specification consisting of a description of the invention and concludng with claims which specifically set forth what the inventor claims to be the novel features of the invention, and drawings which are prepared and filed with the case, and in due course the application is ready for examination in the Patent Office. The question of whether the invention is *new* is then considered. The examination consists in searching through the files of the Patent Office among the patents that have been already issued, and through such literature as may bear upon the subject. The question of whether an invention is new is one of fact, and one of the greatest importance, and upon the showing that the inventor is able to make during the prosecution of the case, depends largely the future success of the patent. The evidence adduced in proving that the invention is not new must be tangible and accessible. A patent would not be refused or overturned on a mere mental concept. There must be some evidence of a substantial character that serves to show that the earlier idea was reduced to practice or at least that there was such a description or drawing made as would be sufficient for one skilled in the art to reduce the invention to practice. If it has not been actually reduced to practice, it must be a concrete, not an abstract, idea.

It is essential that the application for a patent should be filed before the invention has been in public use or on sale for a period of two years. If the inventor has publicly used or sold his invention for a period of two years it becomes public property and he cannot regain the right to obtain a patent. He may, however, make models and experiment with his invention for a much longer period, provided he does not disclose his invention to the public or put it into actual use or on sale for a period of two years. The word "useful" is not one which usually gives either the Patent Office or the inventor a great deal of trouble, as any degree of utility, however insignificant, will serve to entitle the inventor to a patent. It has often happened that an invention which appears, at the time the patent is applied for, to have no special utility, in later years, owing to new discoveries or improvements in the arts, is found to possess the greatest merit and value. Unless an invention is positively meretricious, therefore, it is difficult to assume that it either has no utility or never will have any. Patents are granted for "any new and useful art, machine, manufacture or composition of matter, or any improvement thereon." It is seen from the terms of the statute that almost any creature of the inventive faculty of man becomes a proper subject for a patent. The exceptions are very few. Patents will not be granted, for example, for any invention that offends the law of nature. Under this category may be mentioned perpetual motion machines. Inventions of an immoral nature will not be

considered. Medicines and specifics are not now proper subjects for letters patent, unless some important new discovery is involved.

ABANDONED APPLICATIONS.—While abandonment may arise in different ways, its most frequent occurrence results from a failure to properly prosecute the application. An applicant is given one year by the statute in which to respond to an action on his application by the Patent Office. This period of one year runs from the day on which the letter from the Office is dated. If the last day of the year falls on Sunday the applicant's response must be in the Patent Office on the preceding day, i. e., Saturday. Where an applicant waits until the close of the year before acting on his case he does so at considerable risk, and if his response fails to arrive at the Office by the last day of the year little leniency will be shown him in reviving the case except upon a showing of good and sufficient cause. Not only must the applicant's response come within the year, but it must be fully responsive to the last action by the Office. In other words, his action on the application must be all that the state of the case requires as shown by the last Office letter. An abandoned application may be revived upon petition to the Commissioner if the applicant can show that the delay in the prosecution of the case was unavoidable.

APPEALS.—If an application for a patent has been twice rejected, the applicant may appear from the Primary Examiner to the Board of Examiners-in-Chief. He may further carry the appeal to the Commissioner of Patents and in case he is not satisfied with the latter's decision he may carry the appeal finally to the Court of Appeals of the District of Columbia.

INTERFERENCE.—If two or more individuals have made inventions which can be expressed by the same claim or claims, which must be patentable, interference proceedings may be instituted to determine which applicant is the original or first inventor. Interference proceedings are instituted between applicants whose applications are pending or between a pending application and a patent already issued, provided the latter patent has not been issued for more than two years prior to the filing of the conflicting application. The proceedings are conducted before the Examiner of Interferences. Appeal may be taken from the Examiner of Interferences to the Board of Examiners-in-Chief, and from the Board of Examiners-in-Chief to the Commissioner, and thence to the Court of Appeals of the District of Columbia. Not all the claims for a patent are necessarily involved, but only such as cover the particular feature of the invention which is declared to be in interference. The unsuccessful applicant by eliminating the claim or claims in controversy and all other claims readable upon the disclosure of the successful applicant, may procure allowance of other claims in his application. The disclosure of the successful party virtually becomes a part of the prior art and in the further prosecution of the case it will be so treated. In determining the question of priority of invention witnesses are examined and the proceedings are conducted much in the same manner as in a suit at law. The first step in the proceeding consists in filing with the Commissioner a preliminary statement made under oath, giving the date at which the invention was first conceived and reduced to some tangible form, such as the making of drawings, the construction of a model, or the disclosing of the invention to another. The object of the subsequent examination and cross-examination is to substantiate the date of invention as claimed by the applicants respectively, and to establish the priority of invention.

REISSUES.—A reissue is granted to the original patentee, his legal representative or the assignees of the entire interest, when the original patent is inoperative or invalid by reason of a defective or insufficient specification, or by reason of the patentee claiming as his invention or discovery more than he had a right to claim as new, provided the error has arisen through inadvertence, accident or mistake, and without any fraudulent or deceptive intention. The reissue application must be made and the specification sworn to by the inventor or inventors if he or they be living. What is inadvertence, accident or mistake has been the subject of much litigation and as a general rule the courts require a clear showing of such. No new matter can be introduced into the reissue application, but its subject matter must be capable of being found within the four corners of the original

application. As two years' publication of the subject matter of an invention is a bar to the issue of a patent, the courts as a general rule will not sustain a reissue patent the claims of which are broader than those of the original patent where the reissue application is filed more than two years after the grant of the original patent. The original patent must be surrendered when a reissue application is made. The reissue patent is good only for the unexpired term of the original patent.

PATENTED ARTICLES MUST BE MARKED.—Articles manufactured and sold under a patent must be so marked that the public shall have notice that the article is a patented one. This notice consists of the word "Patented," together with the date when the patent was issued. Damages cannot be recovered in an infringement suit unless the patented articles are so marked or it be shown that the defendant was duly notified of his infringement, but continued after such notice to infringe.

INFRINGEMENT.—In case of an action for the infringement of a patent, the importance of the question of novelty appears from the special pleadings which the defendant may enter, which are as follows:

1. That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,

2. That he had surreptitiously or unjustly obtained the patent for that which was in fact invented by another, who was using reasonable diligence in adapting and perfecting the same; or,

3. That it had been patented or described in some printed publication prior to his supposed invention or discovery thereof; or,

4. That he was not the original and first inventor or discoverer of any material and substantial part of the thing patented; or,

5. That it has been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public.

Damages for infringement of a patent may be recovered at law by action on the case, or in equity by bill, in the name of the patentee or his assignee. The courts having jurisdiction over such cases have the power (1) to grant injunctions against the violation of any right secured by the patent; (2) to allow the recovery of damages sustained by the complainant through such infringement, or the profits obtained by the infringer arising from such infringement. The defendant may be compelled to furnish an accounting showing the amount of the articles manufactured and sold and the profits derived from such sale.

DESIGN PATENTS.—Design patents are issued for any new or original design, whether it be a work of art, statue, bas-relief, design for prints or fabrics, or for any new design or shape or ornament in any article of manufacture. The scope of the design patent was formerly very broad, but recent decisions and enactments have greatly restricted its availability and a design patent cannot now be obtained unless it possesses some inherent artistic quality. Mere utility is not sufficient to entitle a new design to letters patent. The terms of design patents are 3½, 7 or 14 years.

ASSIGNMENTS.—A patent or any interest therein may be sold or assigned like any other piece of property. An inventor may sell or assign his interest or a part interest in his invention, either before the application is filed or while the application is still pending. Under these circumstances the patent may be issued to the assignee or to the inventor and assignee jointly. The patent, if already issued, may be assigned by the owner whether he be the inventor or assignee. The conveyance is effected by an instrument in writing stating the conditions under which the patent is assigned, and the assignment should be recorded in the Patent Office to protect the assignee, as the assignment is void as against any subsequent purchase or mortgagee for a valuable consideration unless it is recorded in the Patent Office within three months from the date thereof.

(Note: The provisions of the Patent Statutes relating to the filing of caveats were repealed by Act of July 1, 1910.)

The stamp "Patent Applied For" or "Patent Pending" simply means that an application for patent has been filed in the Patent Office. Action against infringers cannot be taken until the patent actually issues.

MATERIAL FOR FIGURES SHOWING TOTAL NUMBER OF PATENTS TO DECEMBER 31, 1911.

	Issued During Year.
1836	109
1837	436
1838	515
1839	404
1840	458
1841	490
1842	488
1843	494
1844	478
1845	475
1846	566
1847	495
1848	584
1849	988
1850	884
1851	757
1852	890
1853	846
1854	1,759
1855	1,892
1856	2,315
1857	2,686
1858	3,467
1859	4,165
1860	4,363
1861	3,010
1862	3,221
1863	3,781
1864	4,638
1865	6,049
1866	8,874
1867	12,391
1868	12,544
1869	12,957
1870	12,157
1871	11,687
1872	12,200
1873	11,616
1874	12,230
1875	13,291
1876	14,172
1877	12,920
1878	12,345
1879	12,133
1880	12,926
1881	15,548
1882	18,135
1883	21,196
1884	19,147
1885	23,331
1886	21,797
1887	20,429
1888	19,585
1889	23,360
1890	25,322
1891	22,328
1892	22,661
1893	22,768
1894	19,875
1895	20,883
1896	21,867
1897	22,098
1898	20,404
1899	23,296
1900	24,660
1901	25,558
1902	27,136
1903	31,046
1904	30,267
1905	29,784
1906	31,181
1907	35,880
1908	32,757
1909	36,574
1910	35,168
1911	32,917
United States	1,023,051
France	456,644
Great Britain	443,035
Germany	259,634
Belgium	248,200
Canada	141,406
Italy and Sardinia	106,902
Austria-Hungary	82,933
Austria	70,463
Switzerland	53,449
Hungary	50,474
Spain	46,915
Sweden	35,325
Russia	26,917
Norway	23,856
Denmark	23,023
Japan	21,191

THE UNITED STATES PATENT SYSTEM.

The fundamental principles upon which the present commercial supremacy of the United States is based can be found in three provisions of the Constitution: First, the granting of free speech; second, the offer of remuneration for the use of the products of the brain by providing a limited period during which a man shall enjoys the fruits of his efforts; and third, the protection of personal property by the provision that no person shall be deprived of his property without due process of law.

The Constitutional provision mentioned as second is as follows: "The Congress shall have power * * * to promote the progress of Science and Useful Arts by securing for limited Times to Authors and Inventors, the exclusive Right to their respective Writings and Discoveries."

Upon this foundation stands the United States Patent Office, established for the purpose of carrying out the intentions of the framers of the Constitution and developed far beyond their fondest dreams, by American ingenuity and perseverance.

The value of our patent system is eloquently outlined by Senator Platt, of Connecticut. In speaking on a bill for the reorganization of the Patent Office, he said:

"To my mind, the passage of the act of 1836 creating the Patent Office marks the most important epoch in the history of our development—I think the most important

event in the history of our Government from the Constitution until the Civil War. The establishment of the Patent Office marked the commencement of that marvelous development of the resources of the country which is the admiration and wonder of the world, a development which challenges all history for a parallel; and it is not too much to say that this unexampled progress has been not only dependent upon, but has been coincident with, the growth and development of the patent system of this country. Words fail in attempting to portray the advancement of this country for the last fifty years. We have had fifty years of progress, fifty years of inventions applied to the every-day wants of life, fifty years of patent encouragement, and fifty years of a development in wealth, resources, grandeur, culture, power, which is little short of miraculous. Population, production, business, wealth, comfort, culture, power, grandeur, these have all kept step with the expansion of the inventive genius of the country; and this progress has been made possible only by the inventions of its citizens. All history confirms us in the conclusion that it is the development by the mechanical arts of the industries of a country which brings to it greatness and power and glory. No purely agricultural, pastoral people ever achieved any high standing among the nations of the earth. It is only when the brain evolves and the cunning hand fashions labor-saving machines that a nation begins to throb with new energy and life and expands with a new growth. It is only when thought wrings from nature her untold secret treasures that solid wealth and strength are accumulated by a people."

When the Japanese Government was considering the establishment of a patent system, they sent a commissioner to the United States and he spent several months in Washington, every facility being given him by the Commissioner of Patents. One of the examiners said: "I would like to know why it is that the people of Japan desire to have a patent system."

"I will tell you," said Mr. Takahashi. "You know it is only since Commodore Perry, in 1854, opened the ports of Japan to foreign commerce that the Japanese have been trying to become a great nation, like other nations of the earth, and we have looked about us to see what nations are the greatest, so that we could be like them; and we said, 'There is the United States, not much more than a hundred years old, and America was not discovered by Columbus yet four hundred years ago'; and we said, 'What is it that makes the United States such a great nation?' And we investigated and found it was patents, and we will have patents."

The examiner, in reporting this interview, added: "Not in all history is there an instance of such unbiased testimony to the value and worth of the patent system as practiced in the United States."

The demonstration thus given the commercial world during the last three-quarters of a century of the effect of beneficent patent laws has led to their modification in all the chief industrial countries, and the salient feature of our system—a preliminary examination as to novelty and patentability prior to the grant of a patent—has in late years been incorporated into the patent systems of many foreign countries.

The theory of patents is essentially based on the principle of monopoly. Hence we have the nature and scope of patents changing through the centuries with the change in the conception of the rights of the people. In its origin the patent was a royal grant of special privilege to a favored subject in the form of a private monopoly. Political evolution has restricted it to a grant for a limited number of years of an exclusive right to make, use and vend that which is the product of the inventor's brain. The discoverer of new products in the arts, and the inventor of new processes or machines or improvements in machines, adds to the public wealth and is entitled to a protection in their enjoyment as a recompense. The knowledge of this protection acts also as a stimulus to endeavor. Therefore all civilized nations to-day recognize and protect the inventor's rights.

A few patents for inventions were granted by the provincial governments of the American colonies and by the legislatures of the States, prior to the adoption of the Federal Constitution. On the 5th of September, 1787, it was proposed to incorporate in a constitution a patent and copyright clause. The germinating principle of this clause of the Constitution has vitalized the nation, expanded its powers beyond the wildest dreams of its fathers, and from it more than from any other cause, has grown the magnificent manufacturing and industrial development which we to-day present to the world.

President Washington realized the importance of formulating a law to stimulate inventions, and in his first annual message to Congress, in 1790, said:

"I can not forbear intimating to you the expediency of giving effectual encouragement as well to the introduction of new and useful inventions from abroad as to the exertion of skill and genius in producing them at home."

Congress was quick to act, and on April 10, 1790, the first law upon the subject was enacted. It constituted the Secretary of State, the Secretary of War, and the Attorney-General a board to consider all applications for patents. Owing to the fires that have destroyed the early records of the Patent Office, some question has arisen as to the number of patents issued under this act; but from the best information obtainable, the number is

placed at fifty-seven. The first patent issued was to Samuel Hopkins, July 31, 1790, for making pot and pearl ashes.

The archives of the department show that the issuance of a patent in those days was a state occasion. The President and cabinet met in solemn conclave and, after having deliberated upon whether it was proper for the inventor to have the sole right to the manufacture of the child of his brain, presented him with the papers bestowing this privilege upon him. Hopkins was warmly congratulated by President Washington and the event was recorded in all the diaries of those present.

At this period the clerical part of the work preparatory to the issuance of a patent was performed in the State Department. It would be interesting to see Thomas Jefferson, the Secretary of War, and the Attorney-General, critically examining the application and scrutinizing each point carefully and rigorously. The first year the majority of the applications failed to pass the ordeal, and only three patents were granted. In those days every step in the issuing of a patent was taken with great care and caution. Mr. Jefferson always seeking to impress upon the minds of his officers and the public that the granting of a patent was a matter of no ordinary importance.

The act of 1793 superseded the act of 1790, and remained in force as amended from time to time until the act of 1836 was passed. The act of 1793 was the only act ever passed in this country which provided for the issuance of Letters Patent without the requirement of an examination into the novelty and utility of the invention for which the patent was sought.

The act of 1836, with modifications, remained in force until the revision of the patent laws in 1870. This revision was largely a consolidation of the statutes then in force.

Under the revision of the statutes of the United States in 1874 the act of 1870 was repealed; but the revision substantially reenacted the provisions of the act of 1870.

Under the acts of 1790 and 1793 Letters Patent were granted for a term of fourteen years. There was no provision for extension; but while the act of 1793 was in force Congress extended some thirteen patents

The act of 1836 provided that Letters Patent should be granted for a term of fourteen years, and provision was made for an extension for a term of seven years upon due application and upon a proper showing. Until 1848 petitions for extensions were passed upon by a board consisting of the Secretary of State, the Commissioner of Patents, and the Solicitor of the Treasury. After that time power was vested solely in the Commissioner of Patents.

The patent act of March 2, 1861 (section 16), provided that all patents thereafter granted should remain in force for a term of seventeen years from the date of issue, and the extension of such patents was prohibited.

The consolidated patent act of 1870, while providing that patents should be granted for a term of seventeen years, also provided that patents granted prior to March 2, 1861, might, upon due application and a proper showing, be extended by the Commissioner of Patents for a term of seven years from the expiration of the first term.

By the revision of the patent laws in 1874 the prohibition against the extension of patents was dropped, and since that time Congress has had the power to extend Letters Patent. Congress extended five patents granted under the act of 1836, and in nine instances authorized patentees to apply to the Commissioner of Patents for extension of their patents. So far as one has been able to discover, no patent granted for a term of seventeen years has been extended by Congress.

It was not until 1842 that the statute was passed authorizing the grant of patents for designs. Under that act design patents were granted for seven years. Subsequently provisions were made for granting them for terms of three and one-half, seven, and fourteen years, at the election of the applicant.

By the act of March 2, 1861, the Board of Examiners-in-Chief was established. Prior to that time, and during the incumbency of Commissioner Holt, temporary boards of examiners to decide appeals had been appointed by him, and later on he created a permanent board of three examiners who were to decide on appeal rejected cases and submit their decisions to him for approval.

The act of 1870 made the first provision for an Assistant Commissioner and an Examiner of Interferences. Another provision in that act was the power given the Commissioner, subject to the approval of the Secretary of the Interior, to establish regulations for the conduct of proceedings in the Office.

On January 1, 1898, an act passed March 3, 1897, went into force. Some of the provisions of this act were that applications for patents should be completed and prepared for examination within one year after the filing of the application and that the applicant should prosecute the same within one year after an action thereon or it should be regarded as abandoned (prior to that time two years was the limit); that an inventor should be debarred from receiving a patent if his invention had been first patented by him or his legal representatives or assigns in a foreign country, provided the application for the foreign patent had been filed more than seven months (made twelve months by Act of March 3, 1897), prior to the filing of the application in this country; and that if the invention for which a patent was applied for had been patented or described in any printed publication in this or any foreign country for more than two years prior to the application a patent could not issue.

The first provision for affording accommodations for the Patent Office was in 1810, when Congress authorized the purchase of a building for the General Post-office and for the office of the Keeper of Patents. The building purchased was known as "Blodgett's Hotel," and stood on the site now occupied by the south front of the building until recently occupied by the Post-office Department, and now used by several bureaus of the Interior Department. The east end of this building was used for the records, models, etc., of the Patent Office. This building was destroyed by fire December 13, 1836. On July 4, 1836, an act was passed ap-

propriating $108,000 for the erection of a suitable building for the accommodation of the Patent Office, and within that month the erection of the building was begun.

It was the present south front of the Patent Office, excluding the south ends of the east and west wings. The basement (which is now the first or ground floor) was to be used for storage and analogous purposes, the first or portico floor for office rooms, and the second floor was to be one large hall with galleries on either side, and to have a vaulted roof. This hall was to be used for exhibition purposes, for the display of models of patented and unpatented inventions, and also as a national gallery of the industrial arts and manufactures.

During the erection of the Patent Office building, temporary quarters were provided in the City Hall. In the spring of 1840, the building was completed and the Office moved into it. The sum of $422,011.65 was expended on this building. The patented models were then classified and exhibited in suitable glass cases, while the national gallery was arranged for exhibition of models and specimens.

By the act of March 3, 1849, the Interior Department was established and the Patent Office attached thereto. This same act appropriated $50,000 out of the patent fund to begin the east or Seventh street wing, which was completed in 1852 at a cost of $600,000, $250,000 of which was taken from the revenue of the Patent Office. In 1852 the plans for the entire building, as it now stands, were prepared. The west wing was completed in 1856 and cost $750,000. Work on the north or G street wing was begun the same year. In 1867 this wing was finished at a cost of $575,000. The entire building cost $2,347,-011.65.

In May, 1802, President Jefferson appointed Dr. William Thornton as a clerk at $1,400 per year, to have charge of the issuance of patents. He took the title of Superintendent, and continued to act in that capacity until his death, March 28, 1828. He was succeeded by Dr. William P. Jones, who acted until his removal in the early part of President Jackson's administration. John D. Craig followed Dr. Jones, and in 1834 he was succeeded by B. F. Pickett, who served but a brief period. The last Superintendent was Henry L. Ellsworth, who became the first Commissioner under the act of 1836, and served until 1845. The other Commissioners under that act were:

Edmund Burke, May 4, 1845.
Thomas Ewbank, May 9, 1849.
Silas H. Hodges, November 8, 1852.
Charles Mason, May 16, 1853.
Joseph Holt, September 10, 1857.
William D. Bishop, May 27, 1859.
Philip F. Thomas, February 16, 1860.
D. P. Holloway, March 28, 1861.
T. C. Theaker, August 17, 1865.
Elisha Foote, July 29, 1868.
Samuel S. Fisher, April 26, 1869.

Commissioner Fisher continued as Commissioner for a short time under the act of 1870. Other Commissioners under that act have been:

M. D. Leggett, January 16, 1871.
John M. Thacher, November 4, 1874.
R. H. Duell, October 1, 1875.
Ellis Spear, January 30, 1877.
H. E. Paine, November 1, 1878.
E. M. Marble, May 7, 1880.
Benjamin Butterworth, November 1, 1883.
M. V. Montgomery, March 23, 1885.
B. J. Hall, April 12, 1887.
C. E. Mitchell, April 1, 1889.
William E. Simonds, August 1, 1891.
John S. Seymour, March 31, 1893.
Benjamin Butterworth, April 7, 1897.
Charles H. Duell, February 3, 1898.
F. I. Allen, April 11, 1901.
E. B. Moore, June 1, 1907.

Commissioner Fisher was the first to publish his decisions and to have the copies of the specifications and drawings made by photo-lithography. He also instituted the practice of requiring competitive examinations for entrance to and promotions in the examining force of the office.

Beginning in 1843 and annually thereafter the Patent Office reports were published, which, until 1853, contained merely an alphabetical index of the names of the inventors, a list of the expired patents, and the claims of the patents granted during the week. In 1853 and afterwards small engraved copies of a portion of the drawings were added to the reports to explain the claims.

The act of 1870 authorized the Commissioner to print copies of the claims of the current issues of patents and of such laws, decisions, and rules as were necessary for the information of the public. In conformity with this provision there was published weekly a list giving the numbers, titles, and claims of the patents issued during the week immediately preceding, together with the names and residences of the patentees. This list was first published under the name of The Official Gazette of the United States Patent Office, on January 3, 1872. In July, 1872, portions of the drawings were introduced to illustrate the claims in the patented cases. The Official Gazette has now become one of the most valuable and important of Government publications. Each Senator and Representative is authorized to designate eight public libraries to receive this publication free. One copy is also furnished free to each member of Congress. It is also sent all over the world in exchange for similar publications by other Governments, and its paid subscription list is constantly increasing.

Industrial demand and invention go hand in hand. They act and react, being interdependent. Any change in industrial conditions creating a new demand is at once met by the invention of the means for supplying it, and through new inventions new industrial demands are every year being created. Thus through the process of evolution the industrial field is steadily expanding, and a study of the inventions for any decade will point out the lines of industrial growth for the succeeding decade.

The one millionth patent was issued August 8, 1911, to Frank H. Holton of Akron, Ohio, on an improvement in inflated automobile tires. Patent number one had been issued in 1836 to John Ruggles for a locomotive engine. Patent number 500,000 was issued June 20, 1893. It therefore took 57 years to reach the half million number but only 18 years more to reach the whole million number.

The following figures will give an idea of the relative development of American inventions, beginning with 1850, remembering that 9,957 patents were issued up to July 28, 1836, when the present series of patents was commenced, and that 6,980 patents were issued from July 28, 1836 to December 31, 1849

NUMBER OF PATENTS FOR INVENTIONS ISSUED DURING EACH CALENDAR YEAR, AND NUMBER OF LIVE PATENTS AT THE BEGINNING OF EACH CALENDAR YEAR.

Year.	Number of Patents Issued During the Year.	Number of Live Patents.
1850	884	6,987
1851	757	7,769
1852	890	8,099
1853	846	8,474
1854	1,759	8,928
1855	1,892	10,251
1856	2,315	11,673
1857	2,686	13,518
1858	3,467	15,714
1859	4,165	18,714
1860	4,363	22,435
1861	3,040	26,252
1862	3,221	28,795
1863	3,781	31,428
1864	4,638	34,244
1865	6,099	38,034
1866	8,874	43,415
1867	12,301	51,433
1868	12,544	62,929
1869	12,957	73,824
1870	12,157	85,005
1871	11,687	94,910
1872	12,200	104,022
1873	11,616	112,937
1874	12,230	120,551
1875	13,291	128,547
1876	14,172	141,157
1877	12,920	155,200
1878	12,345	168,011
1879	12,133	177,737
1880	12,926	186,408
1881	15,548	195,325
1882	18,135	206,043
1883	21,196	218,041
1884	19,147	230,360
1885	23,331	237,204
1886	21,797	247,991
1887	20,429	256,831
1888	19,585	265,103
1889	23,360	273,001
1890	25,322	284,161
1891	22,328	297,867
1892	22,661	307,965
1893	22,768	317,335
1894	19,875	325,931
1895	20,883	332,886
1896	21,867	341,424
1897	22,098	351,158
1898	20,404	360,330
1899	23,296	365,186
1900	24,660	370,347
1901	25,558	373,811
1902	27,136	380,222
1903	31,046	384,027
1904	30,267	393,276
1905	29,784	403,114
1906	31,181	413,313
1907	35,880	421,134
1908	32,757	431,692
1909	36,574	442,121
1910	35,168	456,034
1911	32,917	468,434

The marked growth in the number of patents to aliens to be noted in recent years is explained by the very liberal features of our patent system. Foreigners stand here on an equal footing with citizens of this country, and they are neither subjected to restrictions in the matter of annuities or taxes payable after the grant of a patent, nor required to work an invention in this country to maintain it in force, as is the case in most foreign countries.

Moreover, the thorough examination made by our Patent Office as to the novelty of an invention prior to the allowance of an application for a patent—an examination that includes not only the patents and literature of our own country bearing on the art or industry to which the invention relates, but the patents of all patent-granting countries and the technical literature of the world—and the care exercised in criticising the framing of the claims have come to be recognized as of great value in the case of inventions of merit, and hence the majority of foreign inventors patenting in this country take advantage of this feature of our patent system, and secure the action of the Patent Office on an application for a patent before perfecting their patents in their own and other foreign countries, taking due precaution to have their patents in the different countries so issued as to secure the maximum term in each, so far as possible.

In 1911, 4,058 patents were granted to citizens of foreign countries. The relative distribution is as follows:

Germany	1,320
England	935
Canada	554
France	347
Austria-Hungary	140
Switzerland	108
Other European countries	406
All other countries	248

The working of an invention has never been required under our patent laws, though in most foreign countries an invention must be put into commercial use in the country within a specified period or the patent may be declared void. In the case of patents for fine chemicals and like products, which require a high order of technical knowledge and ability for their inception, and skilled workmen for their manufacture, the effect of this requirement, that the industry must be established within the country, has

been most salutary in building up chemical industries within the home country, to some extent at the expense of other countries where the working of a patent is not obligatory. This shows most strongly in the case of carbon dyes and in the patents for chemicals of the class known as carbon compounds, which includes numerous pharmaceutical and medicinal compounds of recent origin, aldehydes, alcohols, phenols, ethers, etc., and many synthetic compounds, as vanillin, artificial musk, etc.

Late years have shown a greatly increased number of patent applications filed by women. With the increase in number there has been a corresponding broadening of the field of their endeavors. When the 1910 census came to the question of patents it listed 944,525 patents granted to men in this country since the beginning of the patent system, but 8,596 patents were credited to women, nine-tenths of one per cent. of the total issue. But the percentage of patents granted to woman increases yearly. Thus, from 1790 until 1888 there were 2,455 patents granted women, and from 1888 to 1895, 2,526, in seven years more than doubling the total that had been accruing for the previous ninety-eight years. And from 1895 until 1910 there were 3,615 patents more, bringing the total number up to 8,596, as stated.

In the presence of much discussion of the relative protection which the several sections of the United States receive under our patent system, it will be instructive to consider the distribution of patents granted during a normal year. The table below shows the states and territories arranged in an order showing the ratio of patents granted in 1911 to the population of the several states and territories.

States and Territories.	Patents and Designs.	One to every—
1. Connecticut	845	1,319
2. District of Columbia	239	1,385
3. California	1,575	1,516
4. Colorado	477	1,675
5. Rhode Island	315	1,723
6. Illinois	3,172	1,778
7. Massachusetts	1,842	1,828
8. New Jersey	1,360	1,866
9. New York	4,777	1,908
10. Nevada	39	2,099
11. Ohio	2,233	2,135
12. Pennsylvania	2,919	2,626
13. Michigan	1,035	2,715
14. Oregon	216	2,735
15. Washington	410	2,785
16. Idaho	105	3,101
17. Wisconsin	703	3,320
18. Montana	112	3,357
19. Missouri	945	3,486
20. Delaware	56	3,613
21. Utah	103	3,624
22. Indiana	726	3,720
23. Nebraska	318	3,749
24. Iowa	583	3,816
25. Minnesota	475	4,370
26. North Dakota	132	4,372
27. Kansas	382	4,427
28. Maryland	272	4,762
29. Arizona	41	4,984
30. Maine	142	5,228
31. New Hampshire	81	5,316
32. South Dakota	109	5,357
33. Wyoming	26	5,614
34. Vermont	61	5,835
35. West Virginia	196	6,230
36. New Mexico	50	6,546
37. Texas	591	6,593
38. Oklahoma	235	7,052
39. Florida	104	7,237
40. Virginia	226	9,122
41. Kentucky	240	9,541
42. Louisiana	165	10,039
43. North Carolina	191	11,551
44. Georgia	224	11,647
45. Arkansas	135	11,663
46. Tennessee	175	12,484
47. Alaska	5	12,871
48. Alabama	163	13,117
49. Mississippi	113	15,904
50. South Carolina	65	23,314

Attention is now directed to how a patent is obtained under the system in the United States. We will suppose a new form of door hinge has been invented. What is the procedure that the inventor should resort to?

In the first place it is highly desirable to employ a *competent attorney*, one skilled in the patent law and practice. The inventor may prepare and prosecute his own application and his case will receive the same careful attention in the Patent Office as if he had employed an attorney. But it should not be forgotten that *Patent practice is technical*. The change of a word here and there may make the difference between *protection* and *no protection*. If the invention is worth patenting it is worth as good a patent as is obtainable, and the inventor should not forget that the patent may have to go through the mill of technical construction in the courts at great expense.

Then a preliminary search should be made. The applicant can make such at the Patent Office or his attorney will have such made. This search is made for the purpose of determining if the device is old. Again it should be remembered that many patents are never used as a basis for manufacture for one reason or another, so that, while the inventor may never have seen a device like that

which he has devised and may have produced it from wholly original thought and experiment, yet someone else may have reached the same result before, patented it, and then done nothing more with it.

Assuming that the preliminary search brings forth no device like the hinge under discussion the next thing is to prepare the application papers. These include a petition, an oath, a drawing, a specification and claims.

The petition is addressed to the Commissioner of Patents setting forth applicant's residence and other formal matters and prays the grant of letters patent. The oath states that applicant believes himself to be the original, first and sole inventor and the other statutory prerequisites. Forms for both are given in a publication entitled "Rules of Practice in the United States Patent Office," which may be obtained from the Patent Office or these forms will be prepared for execution by the attorney.

The drawing must be of a prescribed size and clearly illustrate the construction of the device.

The specification is a detailed description of the device referring to lettered or numbered parts of the drawing, for amplification. The description and drawing must contain a disclosure of the construction, nature and use of the device so full, clear and complete as to enable others skilled in the art to make and use the same, for the public must be informed that they may make and use the device after the patent has expired.

The claims are short statements, drawn in *technical form*, setting forth the elements of the machine or improvement or the steps of the process that applicant believes he has invented. These should be as broad as the state of the art warrants, and should be drawn with very great care to be of any value. Only one skilled in patent practise should undertake the preparation of claims. Too much emphasis cannot be laid on this point.

These application papers, together with $15 for a filing fee, are now to be sent to the Patent Office. Here they are received by the Application Division and duly recorded in books kept for that purpose, and each application is given its serial number. The application is then sent to that division in the office where devices of that nature are examined and given to an examiner skilled in the art to which the device appertains. Then begins the prosecution of the case. The first step is to make an examination of the case.

The American patent system is known as the examination system because of the careful examination given each application to determine the validity of the claims presented for patenting. The examination system is the ideal system, provided the examination can be made with sufficient care to minimize the likelihood of the issue of patents for inventions not of a patentable nature. The field of search, however, yearly increases, and it becomes more and more difficult through lack of time to make a perfect examination. Something more than three million domestic and foreign patents have been issued, while the number of scientific publications has enormously increased. It is only by means of a perfect classification that this great mass of matter can be so divided as to be conveniently accessible for use in the examination of any individual case.

The claims are compared with the disclosures of these United States and foreign patents to see if they are met in terms by devices old in the art. If so they are rejected, and the applicant is so informed, and the patents or publications, together with the reasons if they are not self-evident, are enumerated in a letter written from the office.

Applicant has then one year in which to take action on his case. He may amend his claims to avoid the references cited or he may ask for reconsideration. The application is then taken up for further examination.

During the prosecution of the case questions of interference, appeal, petition, etc., may arise. The procedure in such events is more or less technical and unless applicant has employed an attorney he should study carefully the "Rules of Practice," before referred to, for instructions. The nature of this section will not admit of further detail in meeting the very great number of different situations that may arise.

Assuming, however, that the claims are found to be patentable and the specification and claims unobjectionable in form, the application is passed to issue. The application is sent to the Issue and Gazette Division and

the applicant is informed that the patent will issue upon the receipt of the final fee of $20. He has six months in which to pay this fee. When paid the application is given its patent number, the specification and claims are printed, the drawing is photolithographed and the printed copy and the drawing, together with a copy of the form of patent grant with seal affixed, is sent to the Commissioner for his signature. The patent has then issued and is sent to the inventor.

The country is enriched by inventions and offers for them a small premium; this premium is a seventeen years' monopoly of their fruit—no more, no less. Having purchased the invention for this insignificant price, the purchase is consummated by the publication in the patent records of the details of the invention so that he who runs may read. The whole thing is a strictly business transaction, and this character is emphasized by the fact that the inventor is required to pay for the clerical and expert labor required to put his invention into shape for issuing. His patent fees are designed to cover this expense, and do so, with a considerable margin to spare. Thus the people of the United States are perpetually being enriched by the work of inventors, at absolutely no cost to themselves.

The inventor does not work for love nor for glory alone, but in the hopes of a return for his labor. Glory and love of his species are elements actuating his work, and in many cases he invents because he cannot help himself —because his genius is a hard task master and keeps him at work. But none the less, the great incitement to invention is the hope of obtaining a valuable patent, and without this inducement inventions would be few and far between, and America would, without the patent system, be far in arrears of the rest of the world, instead of leading it, as it does to-day. The few pregnant sentences of the patent statutes—sentences the force of whose every word has been laboriously adjudicated by our highest tribunal, the Supreme Court of the United States—are responsible for America's most characteristic element of prosperity, the work of her inventors, to whom belongs the credit.

It should continue to be the policy of the government of a nation whose inventors have given to the world the cotton gin and the reaper, the sewing machine and the typewriter, the electric telegraph and telephone, the rotary web perfecting printing press and the linotype, the incandescent lamp and the phonograph, and thousands of other inventions that have revolutionized every industrial art, to encourage invention in every lawful way and to provide that, so far as may be necessary, the money paid to the Government by inventors be used for their benefit. The wisdom of the policy has been demonstrated.

The world owes as much to inventors as to statesmen or warriors. To them the United States is the greatest debtor, so much have they advanced American manufactures. Their labor-saving machinery does work that it would take millions of men using hand implements to perform. In this century the debt will be piled still higher, for inventors never rest.

DISTINGUISHED AMERICAN INVENTORS.

Benjamin Franklin; b. Boston, 1706; d. 1790; at 12, printer's apprentice, fond of useful reading; 27 to 40, teaches himself Latin, etc., makes various useful improvements; at 40, studies electricity; 1752, brings electricity from clouds by kite, and invents the lightning rod.

Eli Whitney, inventor of the cotton-gin; b. Westborough, Mass., 1765; d. 1825; went to Georgia 1792 as teacher; 1793, invents the cotton-gin, prior to which a full day's work of one person was to clean by hand one pound of cotton; one machine performs the labor of five thousand persons; 1800, founds Whitneyville, makes firearms, by the interchangeable system for the parts.

Robert Fulton; b. Little Britain, Pa., 1765; d. 1825; artist painter; invents steamboat 1793; invents submarine torpedoes 1797 to 1801; builds steamboat in France 1803; launches passenger boat Clermont at N. Y. 1807, and steams to Albany; 1812, builds steam ferry-boats; 1814, builds first steam war vessel.

Jethro Wood, inventor of the modern cast-iron plough; b. White Creek, N. Y., 1774; d. 1834; patented the plough 1814; previously the plough was a stick of wood plated with iron; lawsuits against infringers consumed his means; Secretary Seward said: "No man has benefited the country pecuniarily more than Jethro Wood, and no man has been as inadequately rewarded."

Thomas Blanchard; b. 1788, Sutton, Mass.; d. 1864; invented tack machine 1806; builds successful steam carriage 1825; builds the stern-wheel boat for shallow waters, now in common use on Western rivers; 1843, patents the lathe for turning irregular forms, now in

common use all over the world for turning lasts, spokes, axe-handles, gun-stocks, hat-blocks, tackle-blocks, etc.

Ross Winans, of Baltimore; b. 1798, N. J.; d. 1877; author of many inventions relating to railways; first patent, 1828; he designed and patented the pivoted, double truck, long passenger cars now in common use. His genius also assisted the development of railways in Russia.

Cyrus H. McCormick, inventor of harvesting machines; b. Walnut Grove, Va., 1809; d. 1884; in 1851 he exhibited his invention at the World's Fair, London, with practical success. The mowing of one acre was one man's day's work; a boy with a mowing machine now cuts 10 acres a day. Mr. McCormick's patents made him a millionaire.

Charles Goodyear, inventor and patentee of the simple mixture of rubber and sulphur, the basis of the present great rubber industries throughout the world; b. New Haven, Conn., 1800; d. 1860; in 1839, by the accidental mixture of a bit of rubber and sulphur on a red-hot stove he discovered the process of vulcanization. The Goodyear patents proved immensely profitable.

Samuel F. B. Morse, inventor and patentee of electric telegraph; b. Charlestown, Mass., 1791; d. 1872; artist painter; exhibited first drawings of telegraph 1832; half-mile wire in operation 1835; caveat 1837; Congress appropriated $30,000 and in 1884 first telegraph line from Washington to Baltimore was opened; after long contests the courts sustained his patents and he realized from them a large fortune.

Elias Howe, inventor of the modern sewing machine; b. Spencer, Mass., 1819; d. 1867; machinist; sewing machine patented 1846; from that time to 1854 his priority was contested and he suffered from poverty, when a decision of the courts in his favor brought him large royalties and he realized several millions from his patent.

James B. Eads; b. 1820; d. 1887; author and constructor of the great steel bridge over the Mississippi at St. Louis, 1867, and the jetties below New Orleans, 1876. His remarkable energy was shown in 1861 when he built and delivered complete to the Government, all within sixty-five days, seven iron-plated steamers, 600 tons each; subsequently other steamers. Some of the most brilliant successes of the Union arms were due to his extraordinary rapidity in constructing these vessels.

Prof. Joseph Henry; b. Albany, N. Y., 1799; d. 1878; in 1828 invented the present form of the electro-magnet which laid the foundation for practically the entire electrical art and is probably the most important single contribution thereto. In 1831 he demonstrated the practicability of the electric current to effect mechanical movements and operate signals at a distant point, which was the beginning of the electro-magnetic telegraph; he devised a system of circuits and batteries, which contained the principle of the relay and local circuit, and also invented one of the earliest electro-magnetic engines. He made many scientific researches in electricity and general physics and left many valuable papers thereon. In 1826 he was a professor in the Albany Academy; was Professor of Natural Philosophy at the College of New Jersey in 1832, and in 1846 was chosen secretary of the Smithsonian Institution at Washington, where he remained until his death. Prof. Henry was probably the greatest of American physicists.

Dr. Alexander Graham Bell, the inventor of the telephone; b. 1847 at Edinburgh, Scotland, moved to Canada 1872 and afterwards to Boston; here he became widely known as an instructor in phonetics and as an authority in teaching the deaf and dumb; in 1873 he began the study of the transmission of musical tones by telegraph; in 1876 he invented and patented the speaking telephone, which has become one of the marvels of the nineteenth century and one of the greatest commercial enterprises of the world; in 1880 the French Government awarded him the Volta prize of $10,000 and he has subsequently received the ribbon of the Legion of Honor from France and many honorary degrees, both at home and abroad; Dr. Bell still continues his scientific work at his home in Washington and has made valuable contributions to the phonograph and aerial navigation.

Samuel Colt; b. Hartford, Conn., 1814; d. 1862; he studied chemistry and became a lecturer on that subject; in 1835 he secured patents on a revolving pistol, a model of which he had made while a boy when at sea; he built and maintained a large armory in Hartford, Conn; in 1847 he contracted to make 1,000 weapons for General Taylor; in 1843 he laid and successfully tested the first submarine telegraph cable.

Thomas A. Edison; b. 1847, at Milan, Ohio; from a poor boy in a country village, with a limited education, he has become the most fertile inventor the world has ever known; his most important inventions are the phonograph in 1877, the incandescent electric lamp, 1878; the quadruplex telegraph, 1874-1878; the electric pen, 1876; magnetic ore separator, 1880; and the three-wire electric circuit, 1883; his first patent was an electric vote-recording machine, taken in 1869; early in life Edison started to run a newspaper, but his genius lay in the field of electricity, where as an expert telegrapher he began his great reputation; his numerous inventions have brought him great wealth; a fine villa in Llewellyn Park, at Orange, N. J., is his home, and his extensive laboratory near by is still the scene of his constant work; he is the world's most persevering inventor, and there are few fields of work into which his inventive genius has not entered; in late years he has done much work in connection with the preparation of detachable molds for cement houses.

Captain John Ericsson; b. 1803 in Sweden; d. in New York, 1889; at 10 years of age, designed a sawmill and a pumping engine; made and patented many inventions in England in early life; in 1829 entered a locomotive in competition with Stephenson's Rocket; in 1836 patented in England his double-screw propeller and shortly after came to the United States and incorporated it in a steamer; in 1861, built for the United States Government the turret ironclad Monitor; was the inventor of the hot-air engine which bears his name; also a torpedo boat which was designed to discharge a torpedo by means of compressed air beneath the water; he was an indefatigable worker and made many other inventions; his diary, kept daily for 40 years, comprehended 14,000 pages.

Charles F. Brush; b. near Cleveland, Ohio, 1849; prominently identified with the development of the dynamo, the arc light and the storage battery, in which fields he made many important inventions; in 1880 the Brush Company put its electric lights into New York City and has since extended its installations into most of the cities and towns of the United

States; in 1881, at the Paris Electrical Exposition, he received the ribbon of the Legion of Honor.

George Westinghouse, Jr.; b. at Central Bridge, N. Y., 1846; while still a boy he modeled and built a steam engine; his first profitable invention was a railroad frog; his most notable inventions, however, were in railroad airbrakes, the first patents for which were taken out in 1872; the system now known by his name has grown to almost universal adoption and constitutes a great labor saving and life saving adjunct to railroad transportation; Mr. Westinghouse, whose home is at Pittsburg, was one of the earliest to develop and use natural gas from deep wells; in late years he has made and patented many inventions in electrical machinery for the development of power and light, and has commercially developed the same on a large scale.

Ottmar Mergenthaler; b. 1854, at Wurtemberg, Germany; d. 1899; inventor of the linotype machine; his early training as a watch and clock maker well fitted him for the painstaking and complicated work of his life, which was to make a machine which would mold the type and set it up in one operation; in 1872 Mergenthaler came to Baltimore and entered a machine shop, in which he subsequently became a partner; the first linotype machine was built in 1886 and put to use in the composing room of the New York Tribune; to-day all large newspapers and publishing houses are equipped with great batteries of these machines, costing over $3,000 each, and each performing the work of five compositors.

Nicola Tesla; b. in the border country of Austria-Hungary, 1857; his first invention, made at Budapest, Hungary, in 1881, was a telephone repeater; he came to the United States in 1884 and later became a naturalized citizen; his work has been largely in electrical fields, but of late he has done much work in the direction of developing steam turbines.

Emile Berliner; b. in Hanover, Germany, May 20, 1851; he invented the loose contact telephone transmitter and many other important improvements in telephone; in 1887 he invented the gramophone, the talking machine well known as the Victor type; he was awarded the John Scott medal by the Franklin Institute.

Wilbur Wright; b. in Henry County, Ind., April 16, 1867; d. May 30, 1912; Orville Wright; b. Aug. 19, 1871; the Wright brothers became interested in mechanical flight in 1896; at the suggestion of Prof. S. P. Langley, Secretary of the Smithsonian Institution, they went to the sand hills of Killdevil, N. C., in 1900, to carry out a series of field experiments; they developed a motor far in advance of those before used in connection with mechanical flight and by 1905 they had a flying machine in which they flew nearly 35 miles at Dayton, Ohio; the first public exhibition of importance was given in this country at Fort Myer in 1908 by Orville Wright; Wilbur Wright at this time was making record flights at Le Mans, France; from then until Wilbur's death the two were constantly associated in developing their heavier than air machines; they became the world's best known aviators.

ABSTRACTS OF DECISIONS.

Where an inventor has completed his invention, if he neither applies for a patent nor puts it to practical use, a subsequent inventor who promptly applies is entitled to the patent, and the first one is deemed to have abandoned his rights. Pattee v. Russell, 3 O. G., 181; Ex parte Carre, 5 O. G., 30; Johnson v. Root, 1 Fisher, 351.

As between two rival inventors, the test of priority is the diligence of the one first to conceive it. If he has been diligent in perfecting it, he is entitled to receive the patent. If he has been negligent, the patent is awarded to his opponent. Robinson on Patents, Sec. 375.

The construction and use for two years in public of a working machine, whether the inventor has or has not abandoned it, excludes the grant of a patent to a subsequent inventor. An abandonment in such case inures to the benefit of the public and not to the benefit of a subsequent inventor. Young v. Van Duser, 16 O. G., 95.

Just where the line of invention lies in an accomplished result is frequently difficult for the courts to determine. That it must extend beyond the merely novel and useful and into the domain of original thought has been determined. The extent of the mental process, however, is immaterial. The result may come out of long consideration or it may be the revelation of a flash of thought. Snyder v. Fisher, 78 O. G., 485.

A function result or principle is not patentable, but a party is entitled to claim his invention as broadly as the prior art permits. Ex parte Pisko, 13; Gourick, 85-15.

It is well settled law that a patent can not issue for a result sought to be accomplished by the inventor of a machine but only for the mechanical means or instrumentalities by which that result is obtained. One cannot describe a machine which will perform a certain function and then claim the function itself and all other machines that may be invented by others to perform the same function. In re Gardner, 140 O. G., 258.

A mere aggregation or combination of old devices is not patentable when the elements are unchanged in *function and effect*. They are patentable when, "by the action of the elements upon each other, or by their joint action on their common object, they perform additional functions and accomplish additional effects." Robinson on Patents, Sec. 154.

A change of shape enabling an instrument to perform new functions is sometimes invention. Wilson v. Coe, 18 Blatch, 532; Collar Co. v. White, 7 O. G., 690, 877.

A patent which is simply for a method of transacting business or keeping accounts is not valid. U. S. Credit System Co v. American Indemnity Co., 63 O. G., 318.

The mere combination of articles disclosed in two former patents will not constitute invention, unless it results in producing a new and useful article not applied by those familiar with the state of the art. In re Faber, 136 O. G., 229.

Patentable novelty may be found in an improvement which simplifies a complicated train of mechanism by eliminating some of the elements with the result that defects due

to the presence of those elements are done away with. Brown v. Huntington Piano Co., 134 Fed., 735.

It involves no invention to omit a part together with its function. Ex parte McElroy, 161 O. G., 753.

Where the claims are distinguishable over the prior art by mere arbitrary variations which amount only to changes of mechanical design and which accomplish no new result, held that such claims are unpatentable. Ex parte Hill, 117 O. G., 2365.

The substitution of one material for another involves invention where the substituted material is used in a relation in which it had not before been used and in which it accomplished new and very beneficial results which were long sought by those skilled in the art. George Frost Co. et al v. Cohn et al, 119 Fed., 505.

There is no invention apparently involved in putting some other mechanism well known in the art and well adapted for such use in the place of previously used mechanism in an old device operating in an old way when such substitution does not involve any material rearrangement. New Departure Bell Co. v. Bevin Bros. Manufacturing Co. 75 O. G.,2196.

Mere change of proportion is not sufficient to avoid a charge of infringement and is not, therefore, sufficient to establish difference of invention. Thompson-Houston Electric Co. v. Western Electric Co. et al. 75 O. G., 347.

In claiming a patent for the discovery of a useful result in any art, machine, manufacture or composition of matter by the use of certain means, the applicant must specify the means he uses in a manner so full and exact that any one skilled in the science to which it appertains can by using the means he specifies without any addition or subtraction from them produce precisely the result he describes. In re Blackmore, 140 O. G., 1209.

A patentee is bound by the limitations imposed on his patent, whether they are voluntary or enforced by the Patent Office, and if he accepts claims not covering his entire invention he abandons the remainder Toepfer v. Goetz, 41 O. G., 933.

Claims should be construed, if possible, to sustain the patentee's right to all he has invented. Ransom v. Mayor of N. Y. (1856), Fisher, 252.

The law requires that manufacturers of patented articles give notice to the public that the goods are patented by marking thereon the date of the patent or giving equivalent notice. When this law is not complied with, only nominal damages can be recovered. Wilson v. Singer Mfg. Co., 4 Bann. & A. 637; McCourt v. Brodie, 5 Fisher, 384.

To prevent fraudulent impositions on the public it is forbidden that unpatented articles be stamped "Patented," and where this is done with intention to deceive, a penalty of one hundred dollars and costs for each article so stamped is provided. Any person may bring action against such offenders. Walker v. Hawxhurst, 5 Blatch. 494; Tompkins v. Butterfield, 25 Fed. Rep 556.

The assignor of a patented invention is estopped from denying the validity of his own patent or his own title to the interest transferred. He cannot become the owner of an older patent and hold it against his assignee. Robinson on Patents, Sec. 787, and notes.

Any assignment which does not convey to the assignee the entire and unqualified monopoly which the patentee holds in the territory specified, or an undivided interest in the entire monopoly, is a mere license. Sanford v. Messer, 2 O. G., 470.

Where a patented machine was sold by complainant with a license agreement that it was to be used only with ink made by complainant and defendant with knowledge of such license agreement sold to the owner of such machine, ink not made by complainant with the expectation that this ink was to be used in connection with such machine, held that the acts of defendant constituted contributory infringement of complainant's patent. U. S. Supreme Court. Henry et al v. A. B. Dick Co., 176 O. G., 751.

FOREIGN PATENTS.

CANADA, DOMINION OF.—The laws of Canada follow somewhat closely the practice in the United States. The term of a patent is eighteen years. The general practice, however, is to divide the fees, making payment only for a term of six years at one time. Applications are subjected to examination as to novelty and usefulness, as in the United States. The application must be filed in Canada not later than during the year following the issue of the United States or other foreign patent. If the inventor neglects to file his application within the twelve months, the invention becomes public property. It is not permissible to import the patented article into the Dominion after twelve months from the date of the Canadian patent. Within two years from said date the manufacture and sale of the article under the patent must have been begun. These exactions may be relaxed under certain conditions.

GREAT BRITAIN.—The term of the patent is fourteen years. An examination is made in Great Britain to ascertain whether the invention has been disclosed in the specifications of British patents granted within fifty years of the filing of the British application. While this is the extent of the examination by the Patent Office, it is sufficient to invalidate a British patent to show in court that the invention was published, or was in public use, in Great Britain before the date of the invention of the British application. In Great Britain the true inventor should apply for the patent in his own name; but if the invention has been conceived in a foreign country, the first introducer may obtain the patent whether he be the true inventor or not. Under these circumstances, therefore, a foreign assignee may apply for the patent in his own name without the true inventor being known. After the fourth year there are annual taxes, gradually increasing in amount. The patent becomes void if the tax is not paid. No time is set within which the manufacture of the invention must be commenced, but after three years if the manufacture has not begun, the patentee may be com-

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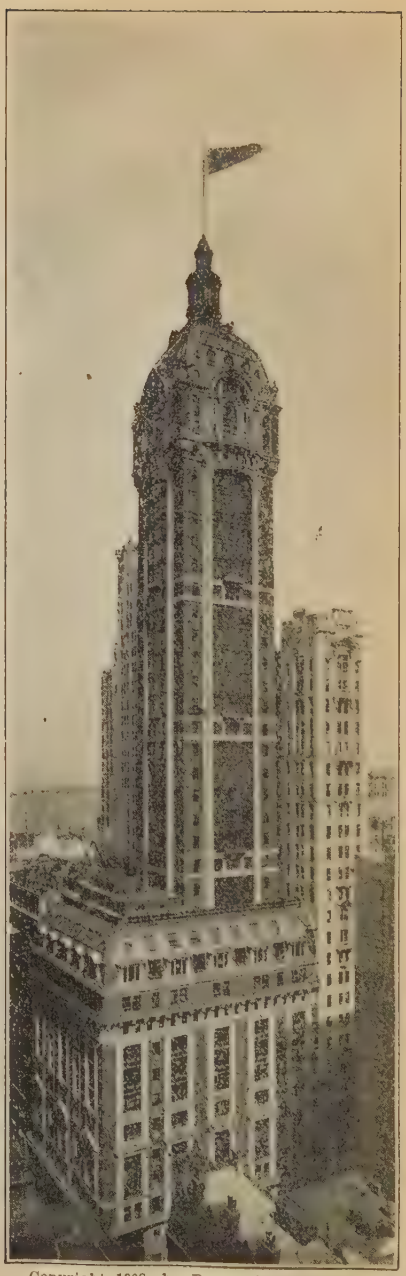
METROPOLITAN LIFE BUILDING.



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SINGER BUILDING.

Photographs to scale ⅞ inch=100 feet.

pelled to grant licenses, or the patent may be declared invalid.

FRANCE.—The term of a patent is fifteen years. There is no examination as to novelty, and the patent is granted to the first applicant, whether or not he be the true inventor. The life of the patent depends upon the payment of annual taxes. The patent must be worked in France within two years from the date of the signing of the patent. If these conditions are not complied with the patent becomes public property but the working provisions referred to are modified by the terms of the International Convention, under which the revocation of a French patent is prevented when the patent is granted to a citizen of a country which is a member of the Convention until after the expiration of the third year counting from the filing of the French application.

GERMANY.—The term of a patent is fifteen years. The patent is issued to the first applicant, but if he is not the true inventor he should, before filing the application, obtain the written consent of the inventor. The application is subjected to a rigid examination. The patent is subject to an annual progressive tax, and must be worked within a period of three years but the working provisions in Germany are modified by a treaty between the United States and Germany, under the provisions of which the revocation of a German patent granted to a citizen of the United States is prevented when the patented article is manufactured in the United States.

AUSTRIA.—The term of a patent is fifteen years. The practice is somewhat similar to the practice in Germany, although the examination is generally not so exacting. The patent is subject to an annual tax and it must be worked within a period of three years.

HUNGARY.—The term of a patent is fifteen years. The laws are similar to those of Germany. There is a progressive annual tax and the patent must be worked within a period of three years.

BELGIUM.—The term of a patent is twenty years. The first applicant obtains the patent whether or not he is the true inventor. There is a small annual tax, and the patent should be worked within one year of the working elsewhere but the working provisions in Belgium are modified under the terms of the International Convention which prevent the revocation of a Belgian patent granted to a citizen of a country which is a member of the Convention until after the expiration of three years counting from the filing of the Belgian patent Application.

ITALY.—The maximum term of a patent is fifteen years. The patent is granted to the first applicant. The patent is subject to an annual tax. The patent becomes invalid if it is not worked within one year or if work under it has been suspended for a whole year, where the term is five years or less; or, where the term is more than five years, if it is not worked within two years or work under it has been suspended for two years but the working provisions in Italy are modified by the provisions of the International Convention, with reference to which see "France," referred to above.

RUSSIA.—The term of the patent is fifteen years. The patent is subject to the payment of annual taxes and must be worked within five years.

SPAIN.—The term of the patent is twenty years, subject to the payment of annual taxes. It must be worked within two years. The patent is issued to the first applicant, whether or not be the true inventor. The working provisions are modified under the terms of the International Convention.

SWITZERLAND.—The term of the patent is fifteen years, subject to an annual tax. Working must take place within three years. The true inventor or his assignee can obtain a patent but when the Swiss patent is granted to a citizen of the United States it is unnecessary for him to work the patent provided the invention is being worked in the United States.

NORWAY.—The term of a patent is fourteen years. The patent is subject to a small annual tax. The application must be filed in the name of the true inventor or his assignee. Applications must be filed within twelve months of the publication of the patent in any foreign country. The patentee may be compelled to grant licenses. The application must be filed either before the issue of the United States patent or during the year following the filing of the United States application.

SWEDEN.—The term of a patent is fifteen years. The patent is subject to an annual tax. The conditions are similar to those existent in Norway. Working is not now necessary in Sweden, but the patentee may be compelled to grant licenses should he fail to carry on the manufacture in Sweden.

DENMARK.—The laws are similar to those of Sweden but the patent should be worked within three years.

PORTUGAL.—The term of the patent varies from one to fifteen years, the fees payable depending upon the term of the patent. A patent must be worked within two years but the working provisions are modified by the provisions of the International Convention under which the working is not required when the patentee is a citizen of a country which is a member of the Convention until after the expiration of three years from the date of filing of the application in Portugal.

NETHERLANDS.—The term of a patent is fifteen years. The patent is granted to the first applicant. The patentee must have a bona fide industrial establishment where the patented article is manufactured within five years or the patent is revocable. The patent is subject to an annually increasing tax.

AUSTRALIA.—The Australian patent protects an invention in Victoria, New South Wales, Queensland, South Australia, Tasmania, West Australia and Papua, but not in New Zealand, which has its own patent law. The term of the Australian patent is fourteen years, a tax being due before the expiration of the seventh year. When the patent is not worked a compulsory license or revocation of the patent may be enforced after two years from the granting of the patent but Australia is a member of the International Convention, and the working provisions are therefore modified by the terms of the convention.

NEW ZEALAND.—The term of the patent is fourteen years, taxes being due before the end of the fourth and seventh years. Compulsory licenses may be obtained.

BRITISH INDIA.—The patent is granted for fourteen years with a possible term of extension. The application should be filed within one year of the issue of the patent in any other country and before the invention has been publicly used or made publicly known in any part of British India. Taxes are payable before the end of the fourth year and annually thereafter. If the patent is not worked to an adequate extent within four years the patentee may be compelled to grant licenses to prevent the revocation of the patent.

TURKEY.—Patents are granted for five, ten or fifteen years. The application must be filed by the inventor or his assignee. The patent is subject to an annual tax. The patent must be worked within two years.

PORTO RICO.—Protection is secured by filing a certified copy of the United States patent with the Secretary of the Government and by complying with certain legal formalities.

PHILIPPINES.—The modus operandi is the same as that just described as applying to Porto Rico.

CUBA.—Since Cuba has become an independent republic it has established a patent system. The term of the patent is seventeen years. Working should be established within one year but the term for the working of the Cuban patent is modified by the provisions of the Convention. No taxes after the issue of the patent.

MEXICO.—The term is twenty years. The application must be filed in Mexico either within twelve months from the date of filing of the first application in another country or within three months from the date of issue of the foreign patent. There are no taxes after the issue of the patent. If the Mexican patent is not worked the patentee may be required, after the expiration of three years of the patent term, to grant licenses permitting others to manufacture in Mexico.

SOUTH AMERICAN REPUBLICS.—Patents are issued by all of the South American Republics. The principal countries in which patent protection is sought are Brazil, in which the laws are quite favorable to foreigners and where the term is fifteen years; Chile, where the term is generally ten years, and Argentina, where the terms are five, ten and fifteen years, according to the merits of the invention. Patents are also frequently secured in Venezuela, Peru, Ecuador, Colombia and Paraguay, but only for certain classes of invention, owing to the expense involved in procuring the patents.

SOUTH AFRICA.—Patents are obtainable in four important states, Cape Colony, Transvaal, Congo Free State and Orange Free State. In Cape Colony the term is fourteen years. There are no conditions as to working the patent. The law is otherwise similar to that of Great Britain.

JAPAN.—The term of the patent is fifteen years. The applicant must be the inventor or derive his title from the inventor. There is an examination of the application. The patent is subject to an increasing tax, and must be worked within three years. The taxes for the first, second and third years of the patent term are paid before the patent is issued. The subsequent taxes are paid annually after the expiration of the third year of the patent term.

THE PATENT LAWS OF THE UNITED STATES.

The Constitutional Provision.—The Congress shall have power * * * to promote the progress of Science and Useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.

STATUTES.

ORGANIZATION OF THE PATENT OFFICE.

Title XI, Rev. Stat., p. 80:

Sec. 475. There shall be in the Department of the Interior an office known as the Patent Office, where all records, books, models, drawings, specifications, and other papers and things pertaining to patents shall be safely kept and preserved.

Sec. 476. There shall be in the Patent Office a Commissioner of Patents, one Assistant Commissioner, and three examiners-in-chief, who shall be appointed by the President, by and with the advice and consent of the Senate. All other offices, clerks and employees authorized by law for the Office shall be appointed by the Secretary of the Interior, upon the nomination of the Commissioner of Patents.

Sec. 480. All officers and employees of the Patent Office shall be incapable, during the period for which they hold their appointments, to acquire or take, directly or indirectly, except by inheritance or bequest, any right of interest in any patent issued by the Office.

Sec. 481. The Commissioner of Patents, under the direction of the Secretary of the Interior, shall superintend or perform all duties respecting the granting and issuing of patents directed by law; and he shall have charge of all books, records, papers, models, machines, and other things belonging to the Patent Office.

Sec. 482. The examiners-in-chief shall be persons of competent legal knowledge and scientific ability, whose duty it shall be, on the written petition of the appellant, to revise and determine upon the validity of the adverse decisions of examiners upon applications for patents, and for reissues of patents, and in interference cases; and when required by the Commissioner, they shall hear and report upon claims for extensions, and perform such other like duties as he may assign them.

Sec. 483. The Commissioner of Patents, subject to the approval of the Secretary of the Interior, may from time to time establish regulations, not inconsistent with law, for the conduct of proceedings in the Patent Office.

Sec. 488. The Commissioner of Patents may require all papers filed in the Patent Office, if not correctly, legibly, and clearly written, to be printed at the cost of the party filing them.

Title XIII, Rev. Stat., p. 169:

Sec. 892. Written or printed copies of any records, books, papers, or drawings belonging to the Patent Office, and of letters patent authenticated by the seal and certified by the Commissioner or Acting Commissioner thereof, shall be evidence in all cases wherein the originals could be evidence; and any person making application therefor, and paying the

fee required by law, shall have certified copies thereof.

Sec. 893. Copies of the specifications and drawings of foreign letters patent certified as provided in the preceding section, shall be prima facie evidence of the fact of the granting of such letters patent, and of the date and contents thereof.

Sec. 894. The printed copies of specifications and drawings of patents, which the Commissioner of Patents is authorized to print for gratuitous distribution, and to deposit in the capitols of the States and Territories, and in the clerks' offices of the district court, shall, when certified by him and authenticated by the seal of his office, be received in all courts as evidence of all matters therein contained.

Sec. 973. When judgment or decree is rendered for the plaintiff or complainant, in any suit at law or in equity, for the infringement of a part of a patent, in which it appears that the patentee, in his specification, claimed to be the original and first inventor or discoverer of any material or substantial part of the thing patented, of which he was not the original and first inventor, no costs shall be recovered, unless the proper disclaimer, as provided by the patent laws, has been entered at the Patent Office before the suit was brought. (See Secs. 4917, 4922.)

Sec. 1537. No patented article connected with marine engines shall hereafter be purchased or used in connection with any steam vessels of war until the same shall have been submitted to a competent board of naval engineers, and recommended by such board, in writing, for purchase and use.

Title XVII, Rev. Stat., p. 292:

Sec. 1673. No royalty shall be paid by the United States to any one of its officers or employees for the use of any patent for the system, or any part thereof, nor for any such patent in which said officers or employees may be directly or indirectly interested.

Title LX, Rev. Stat., 1878, chap. 1, p. 945:

Sec. 4883. All patents shall be issued in the name of the United States of America, under the seal of the Patent Office, and shall be signed by the Commissioner of Patents, and they shall be recorded, together with the specifications, in the Patent Office in books to be kept for that purpose.

Sec. 4884. Every patent shall contain a short title or description of the invention or discovery, correctly indicating its nature and design, and a grant to the patentee, his heirs or assigns, for the term of seventeen years, of the exclusive right to make, use, and vend the invention or discovery throughout the United States and the Territories thereof, referring to the specification for the particulars thereof. A copy of the specification and drawings shall be annexed to the patent and be a part thereof.

Sec. 4885. Every patent shall issue within a period of three months from the date of the payment of the final fee, which fee shall be paid not later than six months from the time at which the application was passed and allowed and notice thereof was sent to the applicant or his agent; and if the final fee is not paid within that period the patent shall be withheld.

Sec. 4886. Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor.

The Secretary of the Interior and the Commissioner of Patents are authorized to grant any officer of the Government, except officers and employees of the Patent Office, a patent for any invention of the classes mentioned in section 4886 of the Revised Statutes when such invention is used or to be used in the public service, without the payment of any fee; Provided, That the applicant in his application shall state that the invention described therein, if patented, may be used by the Government, or any of its officers or employees in prosecution of work for the Government, or by any other person in the United States, without the payment to him of any royalty thereon, which stipulation shall be included in the patent.

Sec. 4887. No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months, in cases within the provisions of section 4886 of the Revised Statutes, and four months in cases of designs, prior to the filing of the application in this country, in which case no patent shall be granted in this country.

An application for patent for an invention or discovery or for a design filed in this country by any person who has previously regularly filed an application for a patent for the same invention, discovery, or design in a foreign country which, by treaty, convention, or law, affords similar privileges to citizens of the United States shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, discovery, or design was first filed in such foreign country, provided the application in this country is filed within twelve months in cases within the provisions of section 4886 of the Revised Statutes, and within four months in cases of designs, from the earliest date on which any such foreign application was filed. But no patent shall be granted on an application for patent for an invention or discovery or a design which had been patented or described in a printed publication in this or any foreign country more than two years before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country for more than two years prior to such filing.

Sec. 4888. Before any inventor or discoverer shall receive a patent for his invention or discovery, he shall make application therefor, in writing, to the Commissioner of Patents, and shall file in the Patent Office a written description of the same, and of the manner and process of making, constructing, compounding, and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it ap-

pertains, or with which it is most nearly connected, to make, construct, compound, and use the same; and in case of a machine, he shall explain the principle thereof, and the best mode in which he has contemplated applying that principle, so as to distinguish it from other inventions; and he shall particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery. The specification and claim shall be signed by the inventor and attested by two witnesses.

Sec. 4889. When the nature of the case admits of drawings, the applicant shall furnish one copy signed by the inventor or his attorney in fact, and attested by two witnesses, which shall be filed in the Patent Office; and a copy of the drawing, to be furnished by the Patent Office, shall be attached to the patent as a part of the specification.

Sec. 4890. When the invention or discovery is of a composition of matter, the applicant, if required by the Commissioner, shall furnish specimens of ingredients and of the composition, sufficient in quantity for the purpose of experiment.

Sec. 4891. In all cases which admit of representation by model, the applicant, if required by the Commissioner, shall furnish a model of convenient size to exhibit advantageously the several parts of his invention or discovery.

Sec. 4892. The applicant shall make oath that he does verily believe himself to be the original and first inventor or discoverer of the art, machine, manufacture, composition, or improvement for which he solicits a patent; that he does not know and does not believe that the same was ever before known or used; and shall state of what country he is a citizen. Such oath may be made before any person within the United States authorized by law to administer oaths, or, when the applicant resides in a foreign country, before any minister, charge d'affaires, consul, or commercial agent holding commission under the Government of the United States, or before any notary public, judge, or magistrate having an official seal and authorized to administer oaths in the foreign country in which the applicant may be, whose authority shall be proved by certificate of a diplomatic or consular officer of the United States,

Sec. 4893. On the filing of any such application and the payment of the fees required by law, the Commissioner of Patents shall cause an examination to be made of the alleged new invention or discovery; and if on such examination it shall appear that the claimant is justly entitled to a patent under the law, and that the same is sufficiently useful and important, the Commissioner shall issue a patent therefor.

Sec. 4894. All applications for patents shall be completed and prepared for examination within one year after the filing of the application, and in default thereof, or upon failure of the applicant to prosecute the same within one year after any action therein, of which notice shall have been given to the applicant, they shall be regarded as abandoned by the parties thereto, unless it be shown to the satisfaction of the Commissioner of Patents that such delay was unavoidable.

Sec. 4895. Patents may be granted and issued or reissued to the assignee of the inventor or discoverer; but the assignment must first be entered of record in the Patent Office. And in all cases of an application by an assignee for the issue of a patent, the application shall be made and the specification sworn to by the inventor or discoverer; and in all cases of an application for a reissue of any patent, the application must be made and the corrected specification signed by the inventor or discoverer, if he is living, unless the patent was issued and the assignment made before the eighth day of July, 1870.

Sec. 4896. When any person, having made any new invention or discovery for which a patent might have been granted, dies before a patent is granted, the right of applying for and obtaining the patent shall devolve on his executor or administrator, in trust for the heirs at law of the deceased, in case he shall have died intestate; or if he shall have left a will disposing of the same, then in trust for his devisees, in as full manner and on the same terms and conditions as the same might have been claimed or enjoyed by him in his lifetime; and when any person having made any new invention or discovery for which a patent might have been granted becomes insane before a patent is granted the right of applying for and obtaining the patent shall devolve on his legally appointed guardian, conservator, or representative in trust for his estate in as full manner and on the same terms and conditions as the same might have been claimed or enjoyed by him while sane and when the application is made by such legal representatives the oath or affirmation required to be made shall be so varied in form that it can be made by them. The executor or administrator duly authorized under the law of any foreign country to administer upon the estate of the deceased inventor shall, in case the said inventor was not domiciled in the United States at the time of his death, have the right to apply for and obtain the patent. The authority of such foreign executor or administrator shall be proved by certificate of a diplomatic or consular officer of the United States.

The foregoing section, as to insane persons, is to cover all applications now on file in the Patent Office or which may be hereafter made.

Sec. 4897. Any person who has an interest in an invention or discovery, whether as inventor, discoverer or assignee, for which a patent was ordered to issue upon the payment of the final fee, but who fails to make payment thereof within six months from the time at which it was passed and allowed, and notice thereof was sent to the applicant or his agent, shall have a right to make an application for a patent for such invention or discovery the same as in the case of an original application. But such second application must be made within two years after the allowance of the original application. But no person shall be held responsible in damages for the manufacture or use of any article or thing for which a patent was ordered to issue under such renewed application prior to the issue of the patent. And upon the hearing of renewed applications preferred under this section, abandonment shall be considered as a question of fact.

Sec. 4898. Every patent or any interest therein shall be assignable in law by an instrument in writing, and the patentee or his assigns or legal representatives may in like manner grant and convey an exclusive right under his patent to the whole or any specified part of the United States. An assignment, grant, or conveyance shall be void as against any subsequent purchaser or mortgagee for a valuable consideration, without notice, unless

it is recorded in the Patent Office within three months from the date thereof.

If any such assignment, grant, or conveyance of any patent shall be acknowledged before any notary public of the several States or Territories or the District of Columbia, or any commissioner of the United States Circuit Court, or before any secretary of legation or consular officer authorized to administer oaths or perform notarial acts under section 1750 of the Revised Statutes, the certificate of such acknowledgment, under the hand and official seal of such notary or other officer, shall be prima facie evidence of the execution of such assignment, grant or conveyance.

Sec. 4899. Every person who purchases of the inventor or discoverer, or, with his knowledge and consent, constructs any newly invented or discovered machine, or other patentable article, prior to the application by the inventor or discoverer for a patent, or who sells or uses one so constructed, shall have the right to use, and vend to others to be used, the specific thing so made or purchased, without liability therefor.

Sec. 4900. It shall be the duty of all patentees, and their assigns and legal representatives, and of all persons making or vending any patented article for or under them, to give sufficient notice to the public that the same is patented either by fixing thereon the word "patented," together with the day and year the patent was granted; or when, from the character of the article, this cannot be done, by fixing to it, or to the package wherein one or more of them is inclosed, a label containing the like notice; and in any suit for infringement, by the party failing so to mark, no damages shall be recovered by the plaintiff, except on proof that the defendant was duly notified of the infringement, and continued, after such notice, to make, use, or vend the article so patented.

Sec. 4901. Every person who, in any manner, marks upon anything made, used, or sold by him for which he has not obtained a patent, the name or any imitation of the name of any person who has obtained a patent therefor, without the consent of such patentee, or his assigns or legal representatives; or

Who, in any manner, marks upon or affixes to any such patented article the word "patent" or "patentee," or the words "letters patent," or any word of like import, with intent to imitate or counterfeit the mark or device of the patentee, without having the license or consent of such patentee or his assigns or legal representatives; or

Who, in any manner, marks upon or affixes to any unpatented article the word "patent" or any word importing that the same is patented, for the purpose of deceiving the public, shall be liable, for every such offense, to a penalty of not less than one hundred dollars, with costs; one-half of said penalty to the person who shall sue for the same, and the other to the use of the United States, to be recovered by suit in any district court of the United States within whose jurisdiction such offense may have been committed.

Sec. 4903. Whenever, on examination, any claim for a patent is rejected, the Commissioner shall notify the applicant thereof, giving him briefly the reasons for such rejection, together with such information and references as may be useful in judging of the propriety of renewing his application or of altering his specification; and if, after receiving such notice, the applicant persists in his claim for a patent, with or without altering his specifications, the Commissioner shall order a re-examination of the case.

Sec. 4904. Whenever an application is made for a patent which, in the opinion of the Commissioner, would interfere with any pending application, or with any unexpired patent, he shall give notice thereof to the applicants, or applicant and patentee, as the case may be, and shall direct the primary examiner to proceed to determine the question of priority of invention. And the Commissioner may issue a patent to the party who is adjudged the prior inventor, unless the adverse party appeals from the decision of the primary examiner, or of the board of examiners-in-chief, as the case may be, within such time, not less than twenty days, as the Commissioner shall prescribe.

Sec. 4905. The Commissioner of Patents may establish rules for taking affidavits and depositions required in cases pending in the Patent Office, and such affidavits and depositions may be taken before any officer authorized by law to take depositions to be used in the courts of the United States or of the State where the officer resides.

Sec. 4906. The clerk of any court of the United States, for any district or Territory wherein testimony is to be taken for use in any contested case pending in the Patent Office, shall, upon the application of any party thereto, or of his agent or attorney, issue a subpoena for any witness residing or being within such district or Territory, commanding him to appear and testify before any officer in such district or Territory authorized to take depositions and affidavits, at any time and place in the subpoena stated. But no witness shall be required to attend at any place more than forty miles from the place where the subpoena is served upon him.

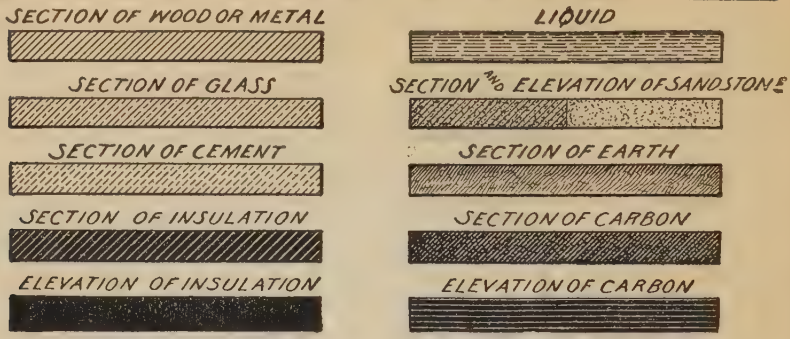
Sec. 4907. Every witness duly subpoenaed and in attendance shall be allowed the same fees as are allowed to witnesses attending the courts of the United States.

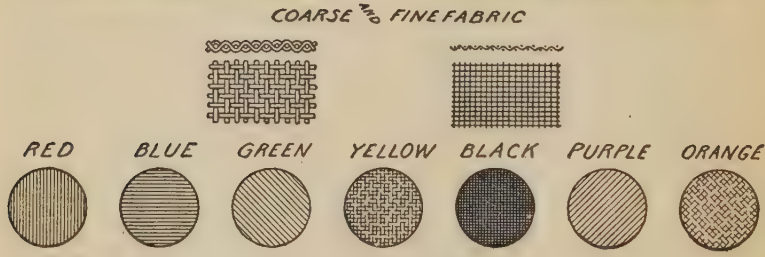
Sec. 4908. Whenever any witness, after being duly served with such subpoena, neglects or refuses to appear, or after appearing refuses to testify, the judge of the court whose clerk issued the subpoena may, on proof of such neglect or refusal, enforce obedience to the process, or punish the disobedience, as in other like cases. But no witness shall be deemed guilty of contempt for disobeying such subpoena, unless his fees and traveling expenses in going to, returning from, and one day's attendance at the place of examination, are paid or tendered him at the time of the service of the subpoena; nor for refusing to disclose any secret invention or discovery made or owned by himself.

Sec. 4909. Every applicant for a patent or for the reissue of a patent, any of the claims of which have been twice rejected, and every party to an interference, may appeal from the decision of the primary examiner, or of the examiner in charge of interferences in such case, to the board of examiners-in-chief; having once paid the fee for such appeal.

Sec. 4910. If such party is dissatisfied with the decision of the examiners-in-chief, he may, on payment of the fee prescribed, appeal to the Commissioner in person.

Sec. 4911. If such party, except a party to an interference, is dissatisfied with the decision of the Commissioner, he may appeal to the Supreme Court of the District of Columbia, sitting in banc.





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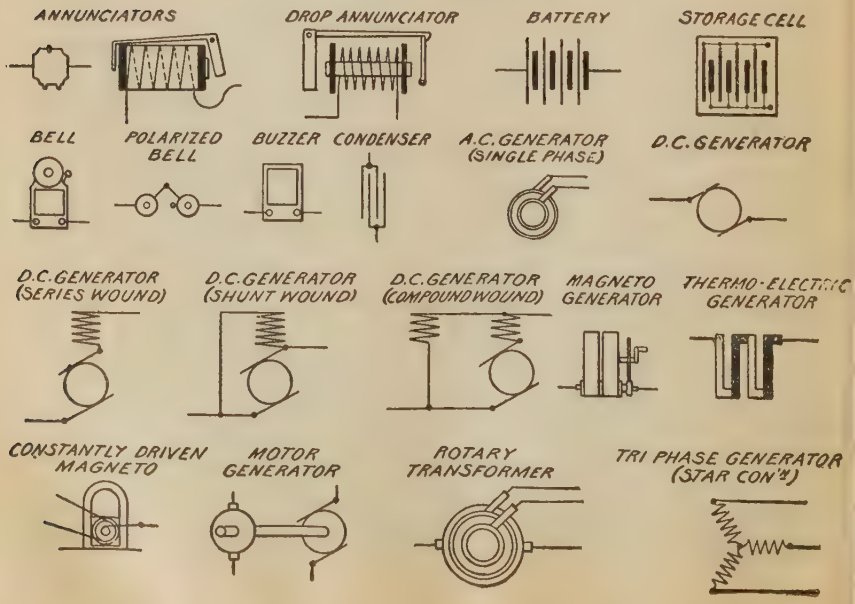

Sec. 4912. When an appeal is taken to the Supreme Court of the District of Columbia, the appellant shall give notice thereof to the Commissioner, and file in the Patent Office within such time as the Commissioner shall appoint, his reasons of appeal, specifically set forth in writing.

Sec. 4913. The court shall, before hearing such appeal, give notice to the Commissioner of the time and place of the hearing, and on receiving such notice the Commissioner shall give notice of such time and place in such manner as the court may prescribe, to all parties who appear to be interested therein. The party appealing shall lay before the court certified copies of all the original papers and evidence in the case, and the Commissioner shall furnish the court with the grounds of his decision, fully set forth in writing, touching all the points involved by the reasons of appeal. And at the request of any party interested, or of the court, the Commissioner and the examiners may be examined under oath, in explanation of the principles of the thing for which a patent is demanded

Sec. 4914. The court, on petition, shall hear and determine such appeal, and revise the decision appealed from in a summary way, on the evidence produced before the Commissioner, at such early and convenient time as the court may appoint; and the revision shall be confined to the points set forth in the reasons of appeal. After hearing the case the court shall return to the Commissioner a certificate of its proceedings and decision, which shall be entered of record in the Patent Office, and shall govern the further proceedings in the case. But no opinion or decision of the court in any such case shall preclude any person interested from the right to contest the validity of such patent in any court wherein the same may be called in question.

Sec. 4915. Whenever a patent on application is refused, either by the Commissioner of Patents or by the Supreme Court of the District of Columbia upon appeal from the Commissioner, the applicant may have remedy by bill in equity; and the court having cognizance thereof, on notice to adverse parties and other due proceedings had, may adjudge that such applicant is entitled, according to law, to receive a patent for his invention, as specified in his claim, or for any part thereof, as the facts in the case may appear. And such adjudication, if it be in favor of the right of the applicant, shall authorize the Commissioner to issue such patent on the applicant filing in the Patent Office a copy of the adjudication, and otherwise complying with the requirements of law. In all cases where there is no opposing party, a copy of the bill shall be served on the Commissioner; and all the expenses of the proceeding shall be paid by the applicant, whether the final decision is in his favor or not.

R. S., U. S., Sup., Vol. 2, c. 74, Feb. 9, 1893. Be it enacted, etc., That there shall be, and there is hereby, established in the District of Columbia a court, to be known as the court of appeals of the District of Columbia.

Sec. 6. That the said court of appeals shall establish a term of the court during each and every month in each year excepting the months of July and August.

Sec. 8. That any final judgment or decree of the said court of appeals may be re-examined and affirmed, reversed, or modified by the Supreme Court of the United States, upon writ of error or appeal, in all causes in which the matter in dispute, exclusive of costs, shall exceed the sum of five thousand dollars, in the same manner and under the same regulations as heretofore provided for in cases of writs of error on judgment or appeals from decrees rendered in the supreme court of the District of Columbia.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in any case heretofore made final in the court of appeals of the District of Columbia, it shall be competent for the Supreme Court to require, by certiorari or otherwise, any such case to be certified to the Supreme Court for its review and determination, with the same power and authority in the case as if it had been carried by appeal or writ of error to the Supreme Court.

Sec. 9. That the determination of appeals from the decision of the Commissioner of Patents, now vested in the general term of the supreme court of the District of Columbia, in pursuance of the provisions of section 780 of the Revised Statutes of the United States, relating to the District of Columbia, shall hereafter be and the same is hereby vested in the court of appeals created by this act;

And in addition, any party aggrieved by a decision of the Commissioner of Patents in any interference case may appeal therefrom to said court of appeals.

Title LX, Rev. Stat., 1878, p. 950:

Sec. 4916. Whenever any patent is inoperative or invalid, by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more than he had a right to claim as new, if the error has arisen by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, the Commissioner shall, on the surrender of such patent and the payment of the duty required by law, cause a new patent for the same invention, and in accordance with the corrected specification, to be issued to the patentee, or, in case of his death or of an assignment of the whole or any undivided part of the original patent, then to his executors, administrators, or assigns, for the unexpired part of the term of the original patent. Such surrender shall take effect upon the issue of the amended patent. The Commissioner may, in his discretion, cause several patents to be issued for distinct and separate parts of the thing patented, upon demand of the applicant, and upon payment of the required fee for a reissue for each of such reissued letters patent. The specifications and claim in every such case shall be subject to revision and restriction in the same manner as original applications are. Every patent so reissued, together with the corrected specifications, shall have the same effect and operation in law, on the trial of all actions for causes thereafter arising, as if the same had been originally filed in such corrected form; but no new matter shall be introduced into the specification, nor in case of a machine patent shall the model or drawings be amended, except each by the other; but when there is neither model nor drawing; amendments may be made upon proof satisfactory to the Commissioner that such new matter or amendment was a part of the original invention, and was omitted from the specification by inadvertence, accident, or mistake, as aforesaid.

Sec. 4917. Whenever, through inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, a patentee has

claimed more than that of which he was the original or first inventor or discoverer, his patent shall be valid for all that part which is truly and justly his own, provided the same is a material or substantial part of the thing patented; and any such patentee, his heirs or assigns, whether of the whole or any sectional interest therein, may, on payment of the fee required by law, make disclaimer of such parts of the thing patented as he shall not chose to claim or to hold by virtue of the patent or assignment, stating therein the extent of his interest in such patent. Such disclaimer shall be in writing, attested by one or more witnesses, and recorded in the patent office; and it shall thereafter be considered as part of the original specification to the extent of the interest possessed by the claimant and by those claiming under him after the record thereof. But no such disclaimer shall affect any action pending at the time of its being filed, except so far as may relate to the question of unreasonable neglect or delay in filing it.

Sec. 4918. Whenever there are interfering patents, any person interested in any one of them, or in the working of the invention claimed under either of them, may have relief against the interfering patentee, and all parties interested under him, by suit in equity against the owners of the interfering patent; and the court, on notice to adverse parties, and other due proceedings had according to the course of equity, may adjudge and declare either of the patents void in whole or in part, or inoperative or invalid in any particular part of the United States, according to the interest of the parties in the patent or the invention patented. But no such judgment or adjudication shall affect the right of any person except the parties to the suit and those deriving title under them subsequent to the rendition of such judgment.

Sec. 4919. Damages for the infringement of any patent may be recovered by action on the case, in the name of the party interested either as patentee, assignee, or grantee. And whenever in any such action a verdict is rendered for the plaintiff, the court may enter judgment thereon for any sum above the amount found by the verdict as the actual damages sustained, according to the circumstances of the case, not exceeding three times the amount of such verdict, together with the costs.

Sec. 4920. In any action for infringement the defendant may plead the general issue, and, having given notice in writing to the plaintiff or his attorney thirty days before, may prove on trial any one or more of the following special matters:

First.—That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,

Second.—That he had surreptitiously or unjustly obtained the patent for that which was in fact invented by another, who was using reasonable diligence in adapting and perfecting the same; or,

Third.—That it has been patented or described in some printed publication prior to his supposed invention or discovery thereof, or more than two years prior to his application for a patent therefor; or,

Fourth.—That he was not the original and first inventor or discoverer of any material and substantial part of the thing patented; or,

Fifth.—That it had been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public.

And in notices as to proof of previous invention, knowledge, or use of the thing patented, the defendant shall state the names of the patentees and the dates of their patents, and when granted, and the names and residences of the persons alleged to have invented or to have had the prior knowledge of the thing patented, and where and by whom it had been used; and if any one or more of the special matters alleged shall be found for the defendant, judgment shall be rendered for him with costs. And the like defenses may be pleaded in any suit in equity for relief against an alleged infringement; and proofs of the same may be given upon like notice in the answer of the defendant, and with the like effect.

Sec. 4921. The several courts vested with jurisdiction of cases arising under the patent laws shall have power to grant injunctions according to the course and principles of courts of equity, to prevent the violation of any right secured by patent, on such terms as the court may deem reasonable; and upon a decree being rendered in any such case for an infringement the complainant shall be entitled to recover, in addition to the profits to be accounted for by the defendant, the damages the complainant has sustained thereby; and the court shall assess the same or cause the same to be assessed under its direction. And the court shall have the same power to increase such damages, in its discretion, as is given to increase the damages found by verdicts in actions in the nature of actions of trespass upon the case.

But in any suit or action brought for the infringement of any patent there shall be no recovery of profits or damages for any infringement committed more than six years before the filing of the bill of complaint or the issuing of the writ in such suit or action, and this provision shall apply to existing causes of action.

Sec. 2. That said courts, when sitting in equity for the trial of patent causes, may impanel a jury of not less than five and not more than twelve persons, subject to such general rules in the premises as may, from time to time, be made by the Supreme Court, and submit to them such questions of fact arising in such cause as such circuit court shall deem expedient.

And the verdict of such jury shall be treated and proceeded upon in the same manner and with the same effect as in the case of issues sent from chancery to a court of law and returned with such findings.

Sec. 4922. Whenever, through inadvertence, accident, or mistake, and without any wilful default or intent to defraud or mislead the public, a patentee has, in his specification, claimed to be the original and first inventor or discoverer of any material or substantial part of the thing patented, of which he was not the original and first inventor or discoverer, every such patentee, his executors, administrators, and assigns, whether of the whole or any sectional interest in the patent, may maintain a suit at law or in equity, for the infringement of any part thereof, which was bona fide his own, if it is a material and substantial part of the thing patented, and definitely distinguishable from the parts claimed without right, not-

withstanding the specifications may embrace more than that of which the patentee was the first inventor or discoverer. But in every such case in which a judgment or decree shall be rendered for the plaintiff, no costs shall be recovered unless the proper disclaimer has been entered at the Patent Office before the commencement of the suit But no patentee shall be entitled to the benefits of this section if he has unreasonably neglected or delayed to enter a disclaimer.

Sec. 4923. Whenever it appears that a patentee, at the time of making his application for the patent, believed himself to be the original and first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery or any part thereof having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication.

DESIGNS.

Sec. 4929. Any person who has invented any new, original, and ornamental design for an article of manufacture, not known or used by others in this country before his invention thereof, and not patented or described in any printed publication in this or any foreign country before his invention thereof, or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law and other due proceedings had, the same as in cases of invention or discoveries covered by section 4886, obtain a patent therefor.

Sec. 4930. The Commissioner may dispense with models of designs when the design can be sufficiently represented by drawings or photographs.

Sec 4931. Patents for designs may be granted for the term of three years and six months, or for seven years, or for fourteen years, as the applicant may, in his application, elect.

Sec. 4932. Patentees of designs issued prior to the second day of March, 1861, shall be entitled to extension of their respective patents for the term of seven years, in the same manner and under the same restrictions as are provided for the extension of patents for inventions or discoveries issued prior to the second day of March, 1861.

Sec. 4933. All the regulations and provisions which apply to obtaining or protecting patents for inventions or discoveries not inconsistent with the provisions of this Title, shall apply to patents for designs.

CHAPTER 105.—An Act to Amend the Law Relating to Patents, Trade-marks, and Copyrights.

Be it enacted, etc., That hereafter during the term of letters patent for a design, it shall be unlawful for any person other than the owner of said letters patent, without the license of such owner to apply the design secured by such letters patent, or any colorable imitation thereof, to any article of manufacture for the purpose of sale, or to sell or expose for sale any article of manufacture to which such design or colorable imitation shall, without the license of the owner, have been applied, knowing that the same has been so applied. Any person violating the provisions, or either of them, of this section, shall be liable in the amount of two hundred and fifty dollars; and in case the total profit made by him from the manufacture or sale, as aforesaid, of the article or articles to which the design, or colorable imitation thereof, has been applied, exceeds the sum of two hundred and fifty dollars, he shall be further liable for the excess of such profit over and above the sum of two hundred and fifty dollars; and the full amount of such liability may be recovered by the owner of the letters patent, to his own use, in any circuit court of the United States having jurisdiction of the parties, either by action at law or upon a bill in equity for an injunction to restrain such infringement.

Sec. 2. That nothing in this act contained shall prevent, lessen, impeach, or avoid any remedy at law or in equity which any owner of letters patent for a design, aggrieved by the infringement of the same, might have had if this act had not been passed; but such owner shall not twice recover the profit made from the infringement

Sec. 4934. The following shall be the rates for patent fees:

On filing each original application for a patent, except in design cases, fifteen dollars.

On issuing each original patent, except in design cases, twenty dollars.

In design cases: For three years and six months, ten dollars; for seven years, fifteen dollars; for fourteen years, thirty dollars.

On every application for the reissue of a patent, thirty dollars.

On filing each disclaimer, ten dollars.

* * * * * * *

On an appeal for the first time from the primary examiners to the examiners-in-chief, ten dollars.

On every appeal from the examiners-in-chief to the Commissioner, twenty dollars.

For certified copies of patents and other papers, including certified printed copies, ten cents per hundred words.

For recording every assignment, power of attorney, or other paper, of three hundred words or under, one dollar; of over three hundred and under one thousand words, two dollars; and for each additional thousand words or fraction thereof, one dollar.

Certified copies of such drawings and specifications may be furnished by the Commissioner of Patents to persons applying therefor upon payment of the present rates for uncertified copies, and twenty-five cents additional for each certification.

For copies of drawings, the reasonable cost of making them.

PATENT RIGHTS VEST IN ASSIGNEE IN BANKRUPTCY.

Sec. 5046. All property conveyed by the bankrupt in fraud of his creditors; all rights in equity, choses in action, patent rights, and copyrights; all debts due him, or any person for his use, and all liens and securities therefor; and all his rights of action for property or estate, real or personal, and for any cause of action which he had against any person arising from contract or from the unlawful taking or detention, or injury to the property of the bankrupt; and all his rights of redeeming such property or estate; together with

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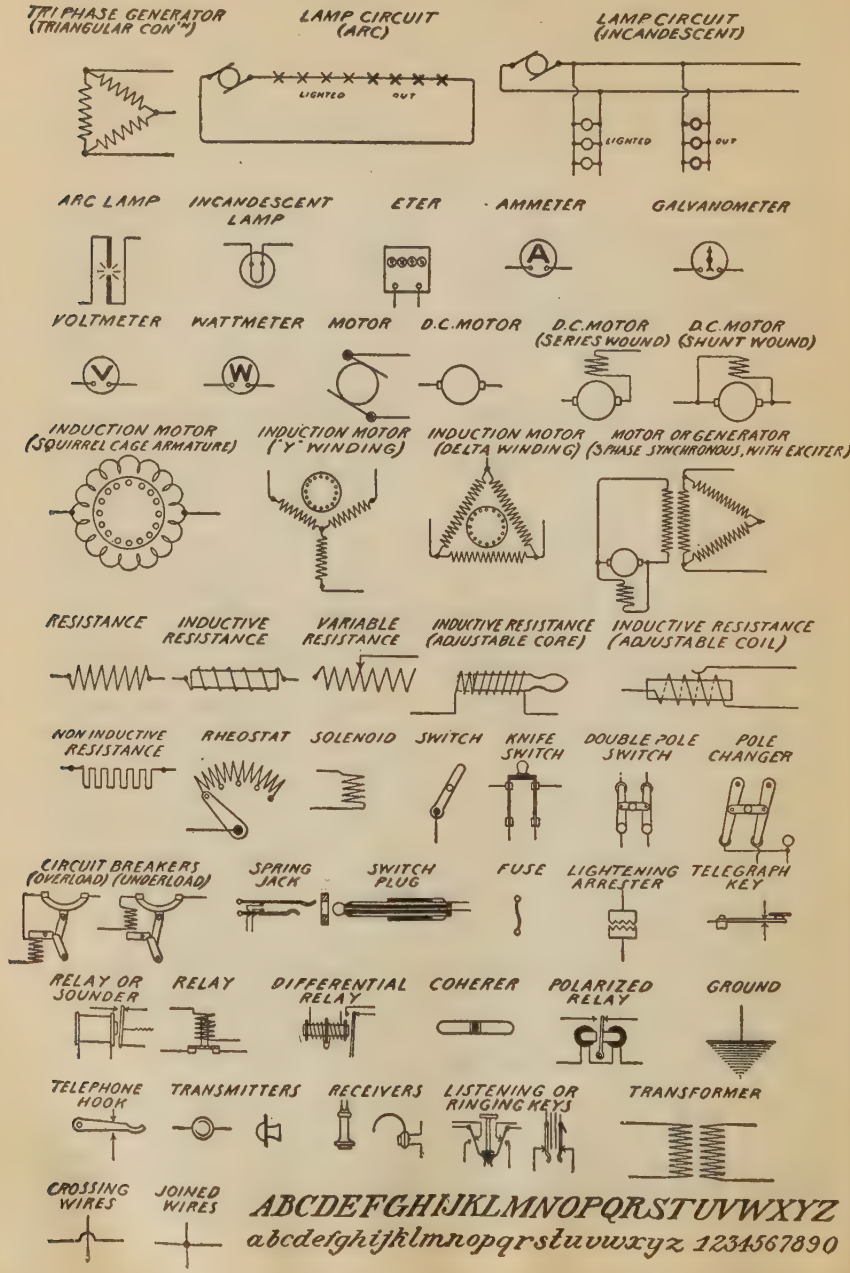

the like right, title, power, and authority to sell, manage, dispose of, sue for, and recover or defend the same, as the bankrupt might have had if no assignment had been made, shall, in virtue of the adjudication of bankruptcy and the appointment of his assignee, but subject to the exceptions stated in the preceding section, be at once vested is [in] such assignee.

Sec. 70. Title to Property. The trustee of the estate of a bankrupt, upon his appointment and qualification, and his successor or successors, if he shall have one or more, upon his or their appointment and qualification, shall in turn be vested by operation of law with the title of the bankrupt, as of the date he was adjudged a bankrupt, except in so far as it is to property which is exempt, to all (1) documents relating to his property; (2) interests in patents, patent rights, copyrights, and trade-marks.

PUBLIC—No. 305. June 25, 1910.

An act to provide additional protection for owners of patents of the United States and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That whenever an invention described in and covered by a patent of the United States shall hereafter be used by the United States without license of the owner thereof or lawful right to use the same, such owner may recover reasonable compensation for such use by suit in the Court of Claims: Provided, however, that said Court of Claims shall not entertain a suit or reward compensation under the provisions of this Act where the claim for compensation is based on the use by the United States of any article heretofore owned, leased, used by or in the possession of the United States: Provided further, That in any such suit the United States may avail itself of any and all defenses, general or special, which might be pleaded by a defendant in an action for infringement, as set forth in Title Sixty of the Revised Statutes, or otherwise; And provided further, That the benefits of this Act shall not inure to any patentee, who, when he makes such claim, is in the employment or service of the Government of the United States; or the assignee of any such patentee; nor shall this act apply to any device discovered or invented by such employee during the time of his employment or service.

COURTS.

Public—No. 475. March 3, 1911

An Act to codify, revise and amend the laws relating to the judiciary.

Title—The Judiciary.

Sec. 24. The district courts shall have original jurisdiction as follows:

Seventh. Of all suits at law or in equity arising under the patent, the copyright, and the trade-mark laws.

Sec. 48. In suits brought for the infringement of letters patent, the district courts of the United States shall have jurisdiction, in law or in equity, in the district of which the defendant is an inhabitant, or in any district in which the defendant, whether a person, partnership, or corporation, shall have committed acts of infringement and have a regular and established place of business. If such suit is brought in a district of which the defendant is not an inhabitant, but in which such defendant has a regular and established place of business, service of process, summons, or subpoena upon the defendant may be made by service upon the agent or agents engaged in conducting such business in the district in which suit is brought.

Sec. 128. The circuit courts of appeals shall exercise appellate jurisdiction to review by appeal or writ or error final decisions in the district courts, * * * * * in all cases other than those in which appeals and writs of error may be taken direct to the Supreme Court * * * * *; the judgments and decrees of the circuit courts of appeal shall be final * * * in all cases arising under the patents laws, under the copyright laws, * * *.

Sec. 239. In any case within its appellate jurisdiction, as defined in section one hundred and twenty-eight, the circuit court of appeals at any time may certify to the Supreme Court of the United States any questions or propositions of law concerning which it desires the instruction of that court for its proper decision; and thereupon the Supreme Court may either give its instruction on the questions and propositions certified to it, which shall be binding upon the circuit court of appeals in such case, or it may require that the whole record and cause be sent up to it for its consideration, and thereupon shall decide the whole matter in controversy in the same manner as if it had been brought there for review by writ of error or appeal.

Sec. 250. Any final judgment or decree of the court of appeals of the District of Columbia may be re-examined and affirmed, reversed, or modified by the Supreme Court of the United States upon writ of error or appeal, in the following cases:

* * * * * * * * * *

Except as provided in the next succeeding section, the judgments and decrees of said court of appeals shall be final in all cases arising under the patent laws, the copyright laws, * * *.

Sec. 251. In any case in which the judgment or decree of said court of appeals is made final by the section last preceding, it shall be competent for the Supreme Court of the United States to require, by certiorari or otherwise, any such case to be certified to it for its review and determination, with the same power and authority in the case as if it had been carried by writ of error or appeal to said Supreme Court. It shall also be competent for said court of appeals, in any case in which its judgment or decree is made final under the section last preceding, at any time to certify to the Supreme Court of the United States any questions or propositions of law concerning which it desires the instruction of that court for their proper decision; and thereupon the Supreme Court may either give its instruction on the questions and propositions certified to it, which shall be binding upon said court of appeals in such case, or it may require that the whole record and cause be sent up to it for its consideration, and thereupon shall decide the whole matter in controversy in the same manner as if it had been brought there for review by writ of error or appeal.

Sec. 256. The jurisdiction vested in the courts of the United States in the cases and proceedings hereinafter mentioned shall be exclusive of the courts of the several States.

Fifth. Of all cases arising under the patent-right, or copyright laws of the United States.

PRINTS AND LABELS.

Excerpts from an Act approved March 4, 1909, entitled an Act to amend and consolidate the Acts respecting copyright, relating to prints and labels.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any person entitled thereto, upon complying with the provisions of this Act, shall have the exclusive right:

(a) To print, reprint, publish, copy, and vend the copyrighted work;

Sec. 7. That no copyright shall subsist in the original text of any work which is in the public domain, or in any work which was published in this country or any foreign country prior to the going into effect of this Act and has not been already copyrighted in the United States, or in any publication of the United States Government, or any reprint, in whole or in part, thereof: Provided, however, That the publication or republication by the Government, either separately or in a public document, of any material in which copyright is subsisting shall not be taken to cause any abridgment or annulment of the copyright or to authorize any use or appropriation of such copyright material without the consent of the copyright proprietor.

Sec. 8. That the author or proprietor of any work made the subject of copyright by this Act, or his executors, administrators, or assigns, shall have copyright for such work under the conditions and for the terms specified in this Act. Provided, however, That the copyright secured by this Act shall extend to the work of an author or proprietor who is a citizen or subject of a foreign state or nation, only:

(a) When an alien author or proprietor shall be domiciled within the United States at the time of the first publication of his work; or

(b) When the foreign state or nation of which such author or proprietor is a citizen or subject grants, either by treaty, convention, agreement, or law, to citizens of the United States the benefit of copyright on substantially the same basis as to its own citizens, or copyright protection substantially equal to the protection secured to such foreign author under this Act or by treaty; or when such foreign state or nation is a party to an international agreement which provides for reciprocity in the granting of copyright, by the terms of which agreement the United States may, at its pleasure, become a party thereto.

The existence of the reciprocal conditions aforesaid shall be determined by the President of the United States, by proclamation made from time to time, as the purposes of this Act may require.

Sec. 9. That any person entitled thereto by this Act may secure copyright for his work by publication thereof with the notice of copyright required by this Act; and such notice shall be affixed to each copy thereof published or offered for sale in the United States by authority of the copyright proprietor, except in the case of books seeking ad interim protection. * * *

Sec. 18. That the notice of copyright required by section nine of this Act shall consist either of the word "Copyright" or the abbreviation "Copr.", accompanied by the name of the copyright proprietor, and if the work be a printed literary, musical, or dramatic work, the notice shall include also the year in which the copyright was secured by publication. In the case, however, of copies of works specified in subsections (f) to (k), inclusive, of section five of this Act, the notice may consist of the letter C inclosed within a circle, accompanied by the initials, monogram, mark, or symbol of the copyright proprietor: Provided, That on some accessible portion of such copies or of the margin, back, permanent base, or pedestal, or of the substance on which such copies shall be mounted, his name shall appear. But in the case of works in which copyright is subsisting when this Act shall go into effect, the notice of copyright may be either in one of the forms prescribed herein or in one of those prescribed by the Act of June eighteenth, eighteen hundred and seventy-four.

Sec. 23. That the copyright secured by this Act shall endure for twenty-eight years from the date of first publication, whether the copyrighted work bears the author's true name or is published anonymously or under an assumed name: Provided, That in the case of any posthumous work or of any periodical, cyclopaedic, or other composite work upon which the copyright was originally secured by the proprietor thereof, or of any work copyrighted by a corporate body (otherwise than as assignee or licensee of the individual author) or by an employer for whom such work is made for hire, the proprietor of such copyright shall be entitled to a renewal and extension of the copyright in such work for the further term of twenty-eight years when application for such renewal and extension shall have been made to the copyright office and duly registered therein within one year prior to the expiration of the original term of copyright: And Provided further, That in the case of any other copyrighted work, including a contribution by an individual author to a periodical or to a cyclopaedic or other composite work when such contribution has been separately registered, the author of such work if still living, or the widow, widower, or children of the author, if the author be not living, or if such author, widow, widower, or children be not living, then the author's, executor's or in the absence of a will, his next of kin shall be entitled to a renewal and extension of the copyright in such work for a further term of twenty-eight years when application for such renewal and extension shall have been made to the copyright office and duly registered therein within one year prior to the expiration of the original term of copyright: And provided further, That in default of the registration of such application for renewal and extension, the copyright in any work shall determine at the expiration of twenty-eight years from first publication.

Sec. 24. That the copyright subsisting in any work at the time when this Act goes into effect may, at the expiration of the term provided for under existing law, be renewed and extended by the author of such work if still living, or the widow, widower, or children of the author, if the author be not living, or if such author, widow, widower, or children be not living, then by the author's executors, or in the absence of a will, his next of kin, for a further period such that the entire term shall be equal to that secured by this Act, including the renewal period: Provided, however, That if the work be a composite work upon which copyright

was originally secured by the proprietor thereof, then such proprietor shall be entitled to the privilege of renewal and extension granted under this section: Provided, That application for such renewal and extension shall be made to the copyright office and duly registered therein within one year prior to the expiration of the existing term.

Sec. 42. That copyright secured under this or previous Acts of the United States may be assigned, granted, or mortgaged by an instrument in writing signed by the proprietor of the copyright, or may be bequeathed by will.

Act approved June 18, 1874, relating to registration of prints and labels.

Sections 3, 4, and 5 of the act of Congress relating to patents, trade-marks, and copyrights, approved June 18, 1874 (18 Stat. L., p. 78)* are as follows:

Sec 3. That in the construction of this act the words "engraving, cut, and print" shall be applied only to pictorial illustrations or works connected with the fine arts, and no prints or labels designed to be used for any other articles of manufacture shall be entered under the copyright law, but may be registered in the Patent Office. And the Commissioner of Patents is hereby charged with the supervision and control of the entry or registry of such prints or labels, in conformity with the regulations provided by law as to copyright of prints, except that there shall be paid for recording the title of any print or label, not a trade-mark, six dollars, which shall cover the expense of furnishing a copy of the record, under the seal of the Commissioner of Patents, to the party entering the same.

Sec. 4. That all laws and parts of laws inconsistent with the foregoing provisions be, and the same are hereby, repealed.

Sec. 5. That this act shall take effect on and after the first day of August, eighteen hundred and seventy-four.

TRADE-MARKS.

Act of February 20, 1905 (As Amended).

AN ACT To authorize the registration of trade-marks used in commerce with foreign nations or among the several States or with Indian tribes, and to protect the same.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the owner of a trade-mark used in commerce with foreign nations, or among the several States, or with Indian tribes, provided such owner shall be domiciled within the territory of the United States, or resides in or is located in any foreign country which, by treaty, convention, or law, affords similar privileges to the citizens of the United States, may obtain registration for such trade-mark by complying with the following requirements: First, by filing in the Patent Office an application therefor, in writing, addressed to the Commissioner of Patents, signed by the applicant, specifying his name, domicile, location, and citizenship; the class of merchandise and the particular description of goods comprised in such class to which the trade-mark is appropriated; a statement of the mode in which the same is applied and affixed to goods, and the length of time during which the trade-mark has been used; a description of the trade-mark itself shall be included, if desired by the applicant or required by the commissioner, provided such description is of a character to meet the approval of the commissioner. With this statement shall be filed a drawing of the trade-mark, signed by the applicant, or his attorney, and such number of specimens of the trade-mark as actually used as may be required by the Commissioner of Patents. Second, by paying into the Treasury of the United States the sum of ten dollars, and otherwise complying with the requirements of this act and such regulations as may be prescribed by the Commissioner of Patents.

Sec. 2 That the application prescribed in the foregoing section, in order to create any right whatever in favor of the party filing it, must be accompanied by a written declaration verified by the applicant, or by a member of the firm or an officer of the corporation or association applying, to the effect that the applicant believes himself or the firm, corporation, or association in whose behalf he makes the application to be the owner of the trade-mark sought to be registered, and that no other person, firm, corporation, or association, to the best of the applicant's knowledge and belief, has the right to use such trade-mark in the United States, either in the identical form or in such near resemblance thereto as might be calculated to deceive; that such trade-mark is used in commerce among the several States, or with foreign nations, or with Indian tribes, and that the description and drawing, presented truly represent the trade-mark sought to be registered. If the applicant resides or is located in a foreign country, the statement required shall, in addition to the foregoing, set forth that the trade-mark has been registered by the applicant, or that an application for the registration thereof has been filed by him in the foreign country in which he resides or is located, and shall give the date of such registration, or the application therefor, as the case may be, except that in the application in such cases it shall not be necessary to state that the mark has been used in commerce with the United States or among the States thereof. The verification required by this section may be made before any person within the United States authorized by law to administer oaths, or, when the applicant resides in a foreign country, before any minister, charge d'affaires, consul, or commercial agent holding commission under the Government of the United States, or before any notary public, judge, or magistrate having an official seal and authorized to administer oaths in the foreign country in which the applicant may be whose authority shall be proved by a certificate of a diplomatic or consular officer of the United States.

Sec. 3. That every applicant for registration of a trade-mark, or for renewal of registration of a trade-mark, who is not domiciled within the United States, shall, before the issuance of the certificate of registration, as hereinafter provided for, designate, by a notice in writing, filed in the Patent Office, some person residing within the United States on whom process or notice of proceedings affecting the right of ownership of the trade-mark of which such applicant may claim to be the owner, brought under the provisions of this act or under other laws of the United

States, may be served, with the same force and effect as if served upon the applicant or registrant in person. For the purposes of this act it shall be deemed sufficient to serve such notice upon such applicant, registrant, or representative by leaving a copy of such process or notice addressed to him at the last address of which the Commissioner of Patents has been notified.

Sec. 4. That an application for registration of a trade-mark filed in this country by any person who has previously regularly filed in any foreign country which, by treaty, convention, or law, affords similar privileges to citizens of the United States an application for registration of the same trade-mark shall be accorded the same force and effect as would be accorded to the same application if filed in this country on the date on which application for registration of the same trade-mark was first filed in such foreign country: Provided, That such application is filed in this country within four months from the date on which the application was first filed in such foreign country: And provided, That certificate of registration shall not be issued for any mark for registration of which application has been filed by an applicant located in a foreign country until such mark has been actually registered by the applicant in the country in which he is located.

Sec. 5. That no mark by which the goods of the owner of the mark may be distinguished from other goods of the same class shall be refused registration as a trade-mark on account of the nature of such mark unless such mark—

(a) Consists of or comprises immoral or scandalous matter.

(b) Consists of or comprises the flag or coat of arms or other insignia of the United States, or any simulation thereof, or of any State, or municipality, or of any foreign nation, or of any design or picture that has been or may hereafter be adopted by any fraternal society as its emblem: Provided, That trade-marks which are identical with a registered or known trade-mark owned and in use by another, and appropriated to merchandise of the same descriptive properties, or which so nearly resemble a registered or known trade-mark owned and in use by another and appropriated to merchandise of the same descriptive properties, as to be likely to cause confusion or mistake in the mind of the public, or to deceive purchasers, shall not be registered: Provided, That no mark which consists merely in the name of an individual, firm, corporation, or association not written, printed, impressed, or woven in some particular or distinctive manner or in association with a portrait of the individual or merely in words or devices which are descriptive of the goods with which they are used, or of the character or quality of such goods, or merely a geographical name or term, shall be registered under the terms of the act: Provided further, That no portrait of a living individual may be registered as a trade-mark, except by the consent of such individual, evidenced by an instrument in writing: And provided further, That nothing herein shall prevent the registration of any mark used by the applicant or his predecessors, or by those from whom title to the mark is derived, in commerce with foreign nations or among the several States, or with Indian tribes, which was in actual and exclusive use as a trade-mark of the applicant or his predecessors from whom he derived title for ten years next preceding February twentieth, nineteen hundred and five: Provided further, That nothing herein shall prevent the registration of a trade-mark otherwise registrable because of its being the name of the applicant or a portion thereof.

Sec. 6. That on the filing of an application for registration of a trade-mark which complies with the requirements of this act, and the payment of the fees herein provided for, the Commissioner of Patents shall cause an examination thereof to be made, and if on such examination it shall appear that the applicant is entitled to have his trade-mark registered under the provisions of this act, the commissioner shall cause the mark to be published at least once in the Official Gazette of the Patent Office. Any person who believes he would be damaged by the registration of a mark may oppose the same by filing notice of opposition, stating the grounds therefor, in the Patent Office within thirty days after the publication of the mark sought to be registered, which said notice of opposition shall be verified by the person filing the same before one of the officers mentioned in section two of this act. An opposition may be filed by a duly authorized attorney, but such opposition shall be null and void unless verified by the opposer within a reasonable time after such filing. If no notice of opposition is filed within said time, the commissioner shall issue a certificate of registration therefor, as hereinafter provided for. If on examination an application is refused, the commissioner shall notify the applicant, giving him his reasons therefor.

Sec. 7. That in all cases where notice of opposition has been filed the Commissioner of Patents shall notify the applicant thereof and the grounds therefor.

Whenever application is made for the registration of a trade-mark which is substantially identical with a trade-mark appropriated to goods of the same descriptive properties, for which a certificate of registration has been previously issued to another, or for registration of which another has previously made application, or which so nearly resembles such trade-mark, or a known trade-mark owned and used by another, as, in the opinion of the commissioner, to be likely to be mistaken therefor by the public, he may declare that an interference exists as to such trade-mark, and in every case of interference or opposition to registration he shall direct the examiner in charge of interferences to determine the question of the right of registration to such trade-mark, and of the sufficiency of objections to registration, in such manner and upon such notice to those interested as the commissioner may by rules prescribe.

The commissioner may refuse to register the mark against the registration of which objection is filed, or may refuse to register both of two interfering marks, or may register the mark, as a trade-mark, for the person first to adopt and use the mark, if otherwise entitled to register the same, unless an appeal is taken, as hereinafter provided for, from his decision, by a party interested in the proceeding, within such time (not less than twenty days) as the commissioner may prescribe.

Sec. 8. That every applicant for the registration of a trade-mark, or for the renewal of the registration of a trade-mark, which application is refused, or a party to an interference against whom a decision has been rendered, or a party who has filed a notice of opposition as to a trade-mark, may appeal from the decision of the examiner in charge

of trade-marks, or the examiner in charge of interferences, as the case may be, to the commissioner in person, having once paid the fee for such appeal.

Sec. 9. That if an applicant for registration of a trade-mark, or a party to an interference as to a trade-mark, or a party who has filed opposition to the registration of a trade-mark, or party to an application for the cancellation of the registration of a trade-mark, is dissatisfied with the decision of the Commissioner of Patents, he may appeal to the court of appeals of the District of Columbia, on complying with the conditions required in case of an appeal from the decision of the commissioner by an applicant for patent, or a party to an interference as to an invention, and the same rules of practice and procedure shall govern in every stage of such proceedings, as far as the same may be applicable.

Sec. 10. That every registered trade-mark, and every mark for the registration of which application has been made, together with the application for registration of the same, shall be assignable in connection with the good will of the business in which the mark is used. Such assignment must be by an instrument in writing and duly acknowledged according to the laws of the country or State in which the same is executed; any such assignment shall be void as against any subsequent purchaser for a valuable consideration, without notice, unless it is recorded in the Patent Office within three months from date thereof. The commissioner shall keep a record of such assignments.

Sec. 11. That certificates of registration of trade-marks shall be issued in the name of the United States of America, under the seal of the Patent Office, and shall be signed by the Commissioner of Patents, and a record thereof, together with printed copies of the drawing and statement of the applicant, shall be kept in books for that purpose. The certificate shall state the date on which the application for registration was received in the Patent Office. Certificates of registration of trade-marks may be issued to the assignee of the applicant, but the assignment must first be entered of record in the Patent Office.

Written or printed copies of any records, books, papers, or drawings relating to trade-marks belonging to the Patent Office, and of certificates of registration, authenticated by the seal of the Patent Office and certified by the commissioner thereof, shall be evidence in all cases wherein the originals could be evidence; and any person making application therefor and paying the fee required by law shall have certified copies thereof.

Sec. 12.—That a certificate of registration shall remain in force for twenty years, except that in the case of trade-marks previously registered in a foreign country such certificate shall cease to be in force on the day on which the trade-mark ceases to be protected in such foreign country, and shall in no case remain in force more than twenty years, unless renewed. Certificates of registration may be from time to time renewed for like periods on payment of the renewal fees required by this act, upon request by the registrant, his legal representatives, or transferees of record in the Patent Office, and such request may be made at any time not more than six months prior to the expiration of the period for which the certificates of registration were issued or renewed. Certificates of registration in force at the date at which this act takes effect shall remain in force for the period for which they were issued, but shall be renewable on the same conditions and for the same periods as certificates issued under the provisions of this act, and when so renewed shall have the same force and effect as certificates issued under this act.

Sec. 13. That whenever any person shall deem himself injured by the registration of a trade-mark in the Patent Office he may at any time apply to the Commissioner of Patents to cancel the registration thereof. The commissioner shall refer such application to the examiner in charge of interferences, who is empowered to hear and determine this question and who shall give notice thereof to the registrant. If it appear after a hearing before the examiner that the registrant was not entitled to the use of the mark at the date of his application for registration thereof, or that the mark is not used by the registrant, or has been abandoned, and the examiner shall so decide, the commissioner shall cancel the registration. Appeal may be taken to the commissioner in person from the decision of examiner of interferences.

Sec. 14. That the following shall be the rates for trade-mark fees:

On filing each original application for registration of a trade-mark, ten dollars: Provided, That an application for registration of a trade-mark pending at the date of the passage of this act, and on which certificate of registration shall not have issued at such date, may, at the option of the applicant, be proceeded with and registered under the provisions of this act without the payment of further fee.

On filing each application for renewal of the registration of a trade-mark, ten dollars.

On filing notice of opposition to the registration of a trade-mark, ten dollars.

On an appeal from the examiner in charge of trade-marks to the Commissioner of Patents, fifteen dollars.

On an appeal from the decision of the examiner in charge of interferences, awarding ownership of a trade-mark or canceling the registration of a trade-mark, to the Commissioner of Patents, fifteen dollars

For certified and uncertified copies of certificates of registration and other papers, and for recording transfers and other papers, the same fees as required by law for such copies of patents and for recording assignments and other papers relating to patents.

Sec. 15. That sections forty-nine hundred and thirty-five and forty-nine hundred and thirty-six of the Revised Statutes, relating to the payment of patent fees and to the repayment of fees paid by mistake, are hereby made applicable to trade-mark fees.

Sec. 16. That the registration of a trade-mark under the provisions of this act shall be prima facie evidence of ownership. Any person who shall, without the consent of the owner thereof, reproduce, counterfeit, copy, or colorably imitate any such trade-mark and affix the same to merchandise of substantially the same descriptive properties as those set forth in the registration, or to labels, signs, prints, packages, wrappers or receptacles intended to be used upon or in connection with the sale of merchandise of substantially the same descriptive properties as those set forth in such registration, and shall use, or shall have used, such reproduction, counterfeit, copy, or colorable imitation in commerce among the several States, or with a foreign nation, or with the Indian tribes, shall be liable to an action for damages therefor at the suit of the owner thereof; and whenever in any such action a

verdict is rendered for the plaintiff, the court may enter judgment therein for any sum above the amount found by the verdict as the actual damages, according to the circumstances of the case, not exceeding three times the amount of such verdict, together with the costs.

Sec. 17. That the circuit and territorial courts of the United States and the supreme court of the District of Columbia shall have original jurisdiction, and the circuit courts of appeal of the United States and the court of appeals of the District of Columbia shall have appellate jurisdiction of all suits at law or in equity respecting trade-marks registered in accordance with the provisions of this act, arising under the present act, without regard to the amount in controversy.

Sec. 18. That writs of certiorari may be granted by the Supreme Court of the United States for the review of cases arising under this act in the same manner as provided for patent cases by the act creating the circuit court of appeals.

Sec. 19. That the several courts vested with jurisdiction of cases arising under the present act shall have power to grant injunctions, according to the course and principles of equity, to prevent the violation of any right of the owner of a trade-mark registered under this act, on such terms as the court may deem reasonable; and upon a decree being rendered in any such case for wrongful use of a trade-mark the complainant shall be entitled to recover, in addition to the profits to be accounted for by the defendant, the damages the complainant has sustained thereby, and the court shall assess the same or cause the same to be assessed under its direction. The court shall have the same power to increase such damages, in its discretion, as is given by section sixteen of this act for increasing damages found by verdict in actions of law; and in assessing profits the plaintiff shall be required to prove defendant's sales only; defendant must prove all elements of cost which are claimed.

Sec. 20. That in any case involving the right to a trade-mark registered in accordance with the provisions of this act, in which the verdict has been found for the plaintiff, or an injunction issued, the court may order that all labels, signs, prints, packages, wrappers, or receptacles in the possession of the defendant, bearing the trade-mark of the plaintiff or complainant, or any reproduction, counterfeit, copy, or colorable imitation thereof, shall be delivered up and destroyed. Any injunction that may be granted upon hearing, after notice to the defendant, to prevent the violation of any right of the owner of a trade-mark registered in accordance with the provisions of this act, by any circuit court of the United States, or by a judge thereof, may be served on the parties against whom such injunction may be granted anywhere in the United States where they may be found, and shall be operative, and may be enforced by proceedings to punish for contempt, or otherwise, by the court by which such injunction was granted, or by any other circuit court, or judge thereof, in the United States, or by the Supreme Court of the District of Columbia, or a judge thereof. The said courts, or judges thereof, shall have jurisdiction to enforce said injunction, as herein provided, as fully as if the injunction had been granted by the circuit court in which it is sought to be enforced. The clerk of the court or judge granting the injunction shall, when required to do so by the court before which application to enforce said injunction is made, transfer without delay to said court a certified copy of all the papers on which the said injunction was granted that are on file in his office.

Sec. 21. That no action or suit shall be maintained under the provisions of this act in any case when the trade-mark is used in unlawful business, or upon any article injurious in itself, or which mark has been used with the design of deceiving the public in the purchase of merchandise, or has been abandoned, or upon any certificate of registration fraudulently obtained.

Sec. 22. That whenever there are interfering registered trade-marks, any person interested in any one of them may have relief against the interfering registrant, and all persons interested under him, by suit in equity against the said registrant, and the court, on notice to adverse parties and other due proceedings had according to the course of equity, may adjudge and declare either of the registrations void in whole or in part according to the interest of the parties in the trade-mark, and may order the certificate of registration to be delivered up to the Commissioner of Patents for cancellation.

Sec. 23. That nothing in this act shall prevent, lessen, impeach, or avoid any remedy at law or in equity which any party aggrieved by any wrongful use of any trade-mark might have had if the provisions of this act had not been passed.

Sec. 24. That all applications for registration pending in the office of the Commissioner of Patents at the time of the passage of this act may be amended with a view to bringing them, and the certificates issued upon such applications, under its provisions, and the prosecution of such applications may be proceeded with under the provisions of this act.

Sec. 25. That any person who shall procure registration of a trade-mark, or entry thereof, in the office of the Commissioner of Patents by a false or fraudulent declaration or representation, oral or in writing, or by any false means, shall be liable to pay any damages sustained in consequence thereof to the injured party, to be recovered by an action on the case.

Sec. 26. That the Commissioner of Patents is authorized to make rules and regulations, not inconsistent with law, for the conduct of proceedings in reference to the registration of trade-marks provided for by this act.

Sec. 27. That no article of imported merchandise which shall copy or simulate the name of any domestic manufacture, or manufacturer or trader, or of any manufacturer or trader located in any foreign country which, by treaty, convention, or law affords similar privileges to citizens of the United States, or which shall copy or simulate a trade-mark registered in accordance with the provisions of this act or shall bear a name or mark calculated to induce the public to believe that the article is manufactured in the United States, or that it is manufactured in any foreign country or locality other than the country or locality in which it is in fact manufactured, shall be admitted to entry at any custom house of the United States, and, in order to aid the officers of the customs in enforcing this prohibition, any domestic manufacturer or trader, and any foreign manufacturer or trader, who is entitled under the provisions of a treaty, convention, declaration or agreement between the United States and any foreign country to the advantages afforded by law to citizens of the United States in respect to trade-marks and commercial names,

may require his name and residence, and the name of the locality in which his goods are manufactured, and a copy of the certificate of registration of his trade-mark, issued in accordance with the provisions of this act, to be recorded in books which shall be kept for this purpose in the Department of the Treasury, under such regulations as the Secretary of the Treasury shall prescribe, and may furnish to the department facsimiles of his name, the name of the locality in which his goods are manufactured, or of his registered trade-mark; and thereupon the Secretary of the Treasury shall cause one or more copies of the same to be transmitted to each collector or other proper officer of the customs.

Sec. 28. That it shall be the duty of the registrant to give notice to the public that a trade-mark is registered, either by affixing thereon the words "Registered in U. S. Patent Office," or abbreviated thus, "Reg. U. S. Pat. Off.," or when, from the character or size of the trade-mark, or from its manner of attachment to the article to which it is appropriated, this cannot be done, then by affixing a label containing a like notice to the package or receptacle wherein the article or articles are inclosed; and in any suit for infringement by a party failing so to give notice of registration no damages shall be recovered, except on proof that the defendant was duly notified of infringement and continued the same after such notice.

Sec. 29. That in construing this act the following rules must be observed, except where the contrary intent is plainly apparent from the context thereof: The United States includes and embraces all territory which is under the jurisdiction and control of the United States. The word "States" includes and embraces the District of Columbia, the Territories of the United States, and such other territory as shall be under the jurisdiction and control of the United States. The terms "person" and "owner," and any other word or term used to designate the applicant or other entitled to a benefit or privilege or rendered liable under the provisions of this act, include a firm, corporation, or association as well as a natural person. The terms "applicant" and "registrant" embrace the successors and assigns of such applicant or registrant. The term "trade-mark" includes any mark which is entitled to registration under the terms of this act, and whether registered or not, and a trade-mark shall be deemed to be "affixed" to an article when it is placed in any manner in or upon either the article itself or the receptacle or package or upon the envelope or other thing in, by, or with which the goods are packed or inclosed or otherwise prepared for sale or distribution.

Sec. 30. That this act shall be in force and take effect April first, nineteen hundred and five. All acts and parts of acts inconsistent with this act are hereby repealed except so far as the same may apply to certificates of registration issued under the act of Congress approved March third, eighteen hundred and eighty-one, entitled "An act to authorize the registration of trade-marks and protect the same," or under the act approved August fifth, eighteen hundred and eighty-two, entitled "An act relating to the registration of trade-marks."

Approved February 20, 1905.

ACT OF MAY 4, 1906.

AN ACT To amend the laws of the United States relating to the registration of trade-marks.

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Sec. 2. That the Commissioner of Patents shall establish classes of merchandise for the purpose of trade-mark registration, and shall determine the particular descriptions of goods comprised in each class. On a single application for registration of a trade-mark the trade-mark may be registered at the option of the applicant for any or all goods upon which the mark has actually been used comprised in a single class of merchandise, provided the particular descriptions of goods be stated.

Sec. 3. That any owner of a trade-mark who shall have a manufacturing establishment within the territory of the United States shall be accorded, so far as the registration and protection of trade-marks used on the products of such establishment are concerned, the same rights and privileges that are accorded to owners of trade-marks domiciled within the territory of the United States by the act entitled "An act to authorize the registration of trade-marks used in commerce with foreign nations or among the several States or with Indian tribes, and to protect the same," approved February twentieth, nineteen hundred and five.

Sec. 4. That this act shall take effect July first, nineteen hundred and six.

Act to incorporate the American National Red Cross, approved January 5, 1905 (as amended June 23, 1910).

Sec. 4. That from and after the passage of this act it shall be unlawful for any person within the jurisdiction of the United States to falsely or fraudulently hold himself out as or represent or pretend himself to be a member of or an agent for the American National Red Cross for the purpose of soliciting, collecting, or receiving money or material; or for any person to wear or display the sign of the Red Cross or any insignia colored in imitation thereof for the fraudulent purpose of inducing the belief that he is a member of or an agent for the American National Red Cross. It shall be unlawful for any person, corporation, or association other than the American National Red Cross and its duly authorized employees and agents and the Army and Navy sanitary and hospital authorities of the United States, for the purpose of trade or as an advertisement, to induce the sale of any article whatsoever or for any business or charitable purpose to use within the territory of the United States of America and its exterior possessions the emblem of the Greek Red Cross on a white ground, or any sign or insignia made or colored in imitation thereof, or of the words "Red Cross" or "Geneva Cross" or any combination of these words: Provided, however, That no person, corporation, or association that actually used or whose assignor actually used the said emblem, sign, insignia, or words for any lawful purpose prior to January fifth, nineteen hundred and five shall be deemed forbidden by this act to continue the use thereof for the same purpose and for the same class of goods. If any person violates the provision of this section he shall be deemed guilty of a misdemeanor, and upon conviction in any Federal court shall be liable to a fine of not less than one or more than five hundred dollars, or imprisonment for a

term not exceeding one year, or both, for each and every offense.

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Sec. 8. That the endowment fund of the American National Red Cross shall be kept and invested under the management and control of a board of nine trustees, who shall be elected from time to time by the incorporators and their successors under such regulations regarding terms and tenure of office, accountability, and expense as said incorporators and successors shall prescribe.

THE COPYRIGHT LAW OF THE UNITED STATES.*

CONSTITUTION, 1787.

Art. 1, Sec. 8. The Congress shall have power: ..... To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.

AN ACT TO AMEND AND CONSOLIDATE THE ACTS RESPECTING COPYRIGHT. MARCH 4, 1909.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any person entitled thereto, upon complying with the provisions of this Act, shall have the exclusive right:

(a) To print, reprint, publish, copy, and vend the copyrighted work;

(b) To translate the copyrighted work into other languages or dialects, or make any other version thereof, if it be a literary work; to dramatize it if it be a nondramatic work; to convert it into a novel or other nondramatic work if it be a drama; to arrange or adapt it if it be a musical work; to complete, execute, and finish it if it be a model or design for a work of art;

(c) To deliver or authorize the delivery of the copyrighted work in public for profit if it be a lecture, sermon, address, or similar production;

(d) To perform or represent the copyrighted work publicly if it be a drama or, if it be a dramatic work and not reproduced in copies for sale, to vend any manuscript or any record whatsoever thereof; to make or to procure the making of any transcription or record thereof by or from which, in whole or in part, it may in any manner or by any method be exhibited, performed, represented, produced, or reproduced; and to exhibit, perform, represent, produce, or reproduce it in any manner or by any method whatsoever;

(e) To perform the copyrighted work publicly for profit if it be a musical composition and for the purpose of public performance for profit; and for the purposes set forth in subsection (a) hereof, to make any arrangement or setting of it or of the melody of it in any system of notation or any form of record in which the thought of an author may be recorded and from which it may be read or reproduced: Provided, That the provisions of this Act, so far as they secure copyright controlling the parts of instruments serving to reproduce mechanically the musical work, shall include only compositions published and copyrighted after this Act goes into effect, and shall not include the works of a foreign author or composer unless the foreign state or nation of which such author or composer is a citizen or subject grants, either by treaty, convention, agreement, or law, to citizens of the United States similar rights: And provided, further, and as a condition of extending the copyright control to such mechanical reproductions, That whenever the owner of a musical copyright has used or permitted or knowingly acquiesced in the use of the copyrighted work upon the parts of instruments serving to reproduce mechanically the musical work, any other person may make similar use of the copyrighted work upon the payment to the copyright proprietor of a royalty of two cents on each such part manufactured, to be paid by the manufacturer thereof, and the copyright proprietor may require, and if so the manufacturer shall furnish, a report under oath on the twentieth day of each month on the number of parts of instruments manufactured during the previous month serving to reproduce mechanically said musical work, and royalties shall be due on the parts manufactured during any month upon the twentieth of the next succeeding month. The payment of the royalty provided for by this section shall free the articles or devices for which such royalty has been paid from further contribution to the copyright except in case of public performance for profit: And provided further, That it shall be the duty of the copyright owner, if he uses the musical composition himself for the manufacture of parts of instruments serving to reproduce mechanically the musical work, or licenses others to do so, to file notice thereof, accompanied by a recording fee, in the copyright office, and any failure to file such notice shall be a complete defense to any suit, action, or proceeding for any infringement of such copyright.

In case of the failure of such manufacturer to pay to the copyright proprietor within thirty days after demand in writing the full sum of royalties due at said rate at the date of such demand the court may award taxable costs to the plaintiff and a reasonable counsel fee, and the court may, in its discretion, enter judgment therein for any sum in addition over the amount found to be due as royalty in accordance with the terms of this Act, not exceeding three times such amount.

The reproduction or rendition of a musical composition by or upon coin-operated machines shall not be deemed a public performance for profit unless a fee is charged for admission to the place where such reproductions or rendition occurs.

Sec. 2. That nothing in this Act shall be construed to annul or limit the right of the author or proprietor of an unpublished work, at common law or in equity, to prevent the copying, publication, or use of such unpublished work without his consent, and to obtain damages therefor.

Sec. 3. That the copyright provided by the Act shall protect all the copyrightable component parts of the work copyrighted, and all matter therein in which copyright is already subsisting, but without extending the duration or scope of such copyright. The copyright upon composite works or periodicals shall give to the proprietor thereof all the rights in respect thereto which he would have if each

*Slightly abridged for this book by Munn & Co., Patent Attorneys.

part were individually copyrighted under this Act.

Sec. 4. That the works for which copyright may be secured under this Act shall include all the writings of an author.

Sec. 5. That the application for registration shall specify to which of the following classes the work in which copyright is claimed belongs:

(a) Books, including composite and cyclopaedic works, directories, gazetteers, and other compilations;

(b) Periodicals, including newspapers;

(c) Lectures, sermons, addresses, prepared for oral delivery;

(d) Dramatic or dramatico-musical compositions;

(e) Musical compositions;

(f) Maps;

(g) Works of art; models or designs for works of art;

(h) Reproductions of a work of art;

(i) Drawings or plastic works of a scientific or technical character;

(j) Photographs;

(k) Prints and pictorial illustrations:

Provided, nevertheless, That the above specifications shall not be held to limit the subject-matter of copyright as defined in section four of this Act, nor shall any error in classification invalidate or impair the copyright protection secured under this Act.

Sec. 6. That compilations or abridgments, adaptations, arrangements, dramatizations, translations, or other versions of works in the public domain, or of copyrighted works when produced with the consent of the proprietor of the copyright in such works, or works republished with new matter, shall be regarded as new works subject to copyright under the provisions of this Act; but the publication of any such new works shall not affect the force or validity of any subsisting copyright upon the matter employed or any part thereof, or be construed to imply an exclusive right to such use of the original works, or to secure or extend copyright in such original works.

Sec. 7. That no copyright shall subsist in the original text of any work which is in the public domain, or in any work which was published in this country or any foreign country prior to the going into effect of this Act and has not been already copyrighted in the United States, or in any publication of the United States Government, or any reprint, in whole or in part, thereof: Provided, however, That the publication or republication by the Government, either separately or in a public document, of any material in which copyright is subsisting, shall not be taken to cause any abridgment or annulment of the copyright or to authorize any use or appropriation of such copyright material without the consent of the copyright proprietor.

Sec. 8. That the author or proprietor of any work made the subject of copyright by this Act, or his executors, administrators, or assigns, shall have copyright for such work under the conditions and for the terms specified in this Act: Provided, however, That the copyright secured by this Act shall extend to the work of an author or proprietor who is a citizen or subject of a foreign state or nation, only:

(a) When an alien author or proprietor shall be domiciled within the United States at the time of the first publication of his work; or

(b) When the foreign state or nation of which such author or proprietor is a citizen or subject grants, either by treaty, convention, agreement, or law, to citizens of the United States the benefit of copyright on substantially the same basis as to its own citizens, or copyright protection substantially equal to the protection secured to such foreign author under this Act or by treaty; or when such foreign state or nation is a party to an international agreement which provides for reciprocity in the granting of copyright, by the terms of which agreement the United States may, at its pleasure, become a party thereto.

The existence of the reciprocal conditions aforesaid shall be determined by the President of the United States, by proclamation made from time to time, as the purposes of this Act may require.

Sec. 9. That any person entitled thereto by this Act may secure copyright for his work by publication thereof with the notice of copyright required by this Act; and such notice shall be affixed to each copy thereof published or offered for sale in the United States by authority of the copyright proprietor, except in the case of books seeking ad interim protection under section twenty-one of this Act.

Sec. 10. That such person may obtain registration of his claim to copyright by complying with the provisions of this Act, including the deposit of copies, and upon such compliance the register of copyrights shall issue to him the certificate provided for in section fifty-five of this Act.

Sec. 11. That copyright may also be had of the works of an author of which copies are not reproduced for sale, by the deposit, with claim of copyright, of one complete copy of such work if it be a lecture or similar production or a dramatic or musical composition; of a photographic print if the work be a photograph; or of a photograph or other identifying reproduction thereof if it be a work of art or a plastic work or drawing. But the privilege of registration of copyright secured hereunder shall not exempt the copyright proprietor from the deposit of copies under sections twelve and thirteen of this Act where the work is later reproduced in copies for sale.

* * *

Sec. 13. That should the copies called for by this Act not be promptly deposited as herein provided, the register of copyrights may at any time after the publication of the work, upon actual notice, require the proprietor of the copyright to deposit them, and after the said demand shall have been made, in default of the deposit of copies of the work within three months from any part of the United States, except an outlying territorial possession of the United States, or within six months from any outlying territorial possession of the United States, or from any foreign country, the proprietor of the copyright shall be liable to a fine of one hundred dollars and to pay to the Library of Congress twice the amount of the retail price of the best edition of the work, and the copyright shall become void.

* * *

Sec. 15. That of the printed book or periodical specified in section five, subsections (a) and (b) of this Act, except the original text of a book of foreign origin in a language or languages other than English, the text of all copies accorded protection under this Act, except as below provided, shall be printed from type set within the limits of the United States, either by hand or by the aid of any kind of typesetting machine, or from plates made within the limits of the United States from type set therein, or, if the text be

produced by lithographic process, or photo-engraving process, then by a process wholly performed within the limits of the United States, and the printing of the text and binding of the said book shall be performed within the limits of the United States; which requirements shall extend also to the illustrations within a book consisting of printed text and illustrations produced by lithographic process, or photo-engraving process, and also to separate lithographs or photo-engravings, except where in either case the subjects represented are located in a foreign country and illustrate a scientific work or reproduce a work of art; but they shall not apply to works in raised characters for the use of the blind, or to books of foreign origin in a language or languages other than English, or to books published abroad in the English language seeking ad interim protection under this Act.

* * *

Sec. 18. That the notice of copyright required by section nine of this Act shall consist either of the word "Copyright" or the abbreviation "Copr.", accompanied by the name of the copyright proprietor, and if the work be a printed literary, musical, or dramatic work, the notice shall include also the year in which the copyright was secured by publication. In the case, however, of copies of works specified in subsections (f) to (k), inclusive, of section five of this Act, the notice may consist of the letter C inclosed within a circle, accompanied by the initials, monogram, mark, or symbol of the copyright proprietor: Provided, That on some accessible portion of such copies or of the margin, back, permanent base, or pedestal, or of the substance on which such copies shall be mounted, his name shall appear. But in the case of works in which copyright is subsisting when this Act shall go into effect, the notice of copyright may be either in one of the forms prescribed herein or in one of those prescribed by the Act of June eighteenth, eighteen hundred and seventy-four.

Sec. 19. That the notice of copyright shall be applied, in the case of a book or other printed publication upon its title-page or the page immediately following, or if a periodical either upon the title-page or upon the first page of text of each separate number or under the title heading, or if a musical work either upon its title-page or the first page of music: Provided, That one notice of copyright in each volume or in each number of a newspaper or periodical published shall suffice.

Sec. 20. That where the copyright proprietor has sought to comply with the provisions of this Act with respect to notice, the omission by accident or mistake of the prescribed notice from a particular copy or copies shall not invalidate the copyright or prevent recovery for infringement against any person who, after actual notice of the copyright, begins an undertaking to infringe it, but shall prevent the recovery of damages against an innocent infringer who has been misled by the omission of the notice; and in a suit for infringement no permanent injunction shall be had unless the copyright proprietor shall reimburse to the innocent infringer his reasonable outlay innocently incurred if the court, in its discretion, shall so direct.

Sec. 21. That in the case of a book published abroad in the English language before publication in this country, the deposit in the copyright office, not later than thirty days after its publication abroad, of one complete copy of the foreign edition, with a request for the reservation of the copyright and a statement of the name and nationality of the author and of the copyright proprietor and of the date of publication of the said book, shall secure to the author or proprietor an ad interim copyright, which shall have all the force and effect given to copyright by this Act, and shall endure until the expiration of thirty days after such deposit in the copyright office.

Sec. 22. That whenever within the period of such ad interim protection an authorized edition of such book shall be published within the United States, in accordance with the manufacturing provisions specified in section fifteen of this Act, and whenever the provisions of this Act as to deposit of copies, registration, filing of affidavit, and the printing of the copyright notice shall have been duly complied with, the copyright shall be extended to endure in such book for the full term elsewhere provided in this Act.

Sec. 23. That the copyright secured by this Act shall endure for twenty-eight years from the date of first publication, whether the copyrighted work bears the author's true name or is published anonymously or under an assumed name: Provided, That in the case of any posthumous work or of any periodical, cyclopaedic, or other composite work upon which the copyright was originally secured by the proprietor thereof, or of any work copyrighted by a corporate body (otherwise than as assignee or licensee of the individual author) or by an employer for whom such work is made for hire, the proprietor of such copyright shall be entitled to a renewal and extension of the copyright in such work for the further term of twenty-eight years when application for such renewal and extension shall have been made to the copyright office and duly registered therein within one year prior to the expiration of the original term of copyright: And provided further, That in the case of any other copyrighted work, including a contribution by an individual author to a periodical or to a cyclopaedic or other composite work when such contribution has been separately registered, the author of such work, if still living, or the widow, widower, or children of the author, if the author be not living, or if such author, widow, widower, or children be not living, then the author's executors, or in the absence of a will, his next of kin shall be entitled to a renewal and extension of the copyright in such work for a further term of twenty-eight years when application for such renewal and extension shall have been made to the copyright office and duly registered therein within one year prior to the expiration of the original term of copyright: And provided further, That in default of the registration of such application for renewal and extension, the copyright in any work shall determine at the expiration of twenty-eight years from first publication.

Sec. 24. That the copyright subsisting in any work at the time when this Act goes into effect may, at the expiration of the term provided for under existing law, be renewed and extended by the author of such work if still living, or the widow, widower, or children of the author, if the author be not living, or if such author, widow, widower, or children be not living, then by the author's executors, or in the absence of a will, his next of kin, for a further period such that the entire term shall be equal to that secured by this Act,

including the renewal period: Provided, however, That if the work be a composite work upon which copyright was originally secured by the proprietor thereof, then such proprietor shall be entitled to the privilege of renewal and extension granted under this section: Provided, That application for such renewal and extension shall be made to the copyright office and duly registered therein within one year prior to the expiration of the existing term.

Sec. 25. That if any person shall infringe the copyright in any work protected under the copyright laws of the United States such person shall be liable:

(a) To an injunction restraining such infringement;

(b) To pay to the copyright proprietor such damages as the copyright proprietor may have suffered due to the infringement, as well as all the profits which the infringer shall have made from such infringement, and in proving profits the plaintiff shall be required to prove sales only and the defendant shall be required to prove every element of cost which he claims, or in lieu of actual damages and profits such damages as to the court shall appear to be just, and in assessing such damages the court may, in its discretion, allow the amounts as hereinafter stated, but in the case of a newspaper reproduction of a copyrighted photograph such damages shall not exceed the sum of two hundred dollars nor be less than the sum of fifty dollars, and such damages shall in no other case exceed the sum of five thousand dollars nor be less than the sum of two hundred and fifty dollars, and shall not be regarded as a penalty:

First. In the case of a painting, statue, or sculpture, ten dollars for every infringing copy made or sold by or found in the possession of the infringer or his agents or employees;

Second. In the case of any work enumerated in section five of this Act, except a painting, statue, or sculpture, one dollar for every infringing copy made or sold by or found in the possession of the infringer or his agents or employees;

Third. In the case of a lecture, sermon, or address, fifty dollars for every infringing delivery;

Fourth. In the case of a dramatic or dramatico-musical or a choral or orchestral composition, one hundred dollars for the first and fifty dollars for every subsequent infringing performance; in the case of other musical compositions, ten dollars for every infringing performance;

(c) To deliver up on oath, to be impounded during the pendency of the action, upon such terms and conditions as the court may prescribe, all articles alleged to infringe a copyright;

(d) To deliver up on oath for destruction all the infringing copies or devices, as well as all plates, molds, matrices, or other means for making such infringing copies as the court may order;

(e) Whenever the owner of a musical copyright has used or permitted the use of the copyrighted work upon the parts of musical instruments serving to reproduce mechanically the musical work, then in case of infringement of such copyright by the unauthorized manufacture, use, or sale of interchangeable parts, such as disks, rolls, bands, or cylinders for use in mechanical music-producing machines adapted to reproduce the copyrighted music, no criminal action shall be brought, but in a civil action an injunction may be granted upon such terms as the court may impose, and the plaintiff shall be entitled to recover in lieu of profits and damages a royalty as provided in section one, subsection (e), of this Act: Provided also, That whenever any person, in the absence of a license agreement, intends to use a copyrighted musical composition upon the parts of instruments serving to reproduce mechanically the musical work, relying upon the compulsory license provision of this Act, he shall serve notice of such intention, by registered mail, upon the copyright proprietor at his last address disclosed by the records of the copyright office, sending to the copyright office a duplicate of such notice; and in case of his failure so to do the court may, in its discretion, in addition to sums hereinabove mentioned, award the complainant a further sum, not to exceed three times the amount provided by section one, subsection (e), by way of damages, and not as a penalty, and also a temporary injunction until the full award is paid.

Rules and regulations for practice and procedure under this section shall be prescribed by the Supreme Court of the United States.

* * *

Sec. 28. That any person who willfully and for profit shall infringe any copyright secured by this Act, or who shall knowingly and willfully aid or abet such infringement, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by imprisonment for not exceeding one year or by a fine of not less than one hundred dollars nor more than one thousand dollars, or both, in the discretion of the court: Provided, however, That nothing in this Act shall be so construed as to prevent the performance of religious or secular works, such as oratorios, cantatas, masses, or octavo choruses by public schools, church choirs, or vocal societies, rented, borrowed, or obtained from some public library, public school, church choir, school choir, or vocal society, provided the performance is given for charitable or educational purposes and not for profit.

Sec. 29. That any person who, with fraudulent intent, shall insert or impress any notice of copyright required by this Act, or words of the same purport, in or upon any uncopyrighted article, or with fraudulent intent shall remove or alter the copyright notice upon any article duly copyrighted shall be guilty of a misdemeanor, punishable by a fine of not less than one hundred dollars and not more than one thousand dollars. Any person who shall knowingly issue or sell any article bearing a notice of United States copyright which has not been copyrighted in this country, or who shall knowingly import any article bearing such notice or words of the same purport, which has not been copyrighted in this country, shall be liable to a fine of one hundred dollars.

Sec. 30. That the importation into the United States of any article bearing a false notice of copyright when there is no existing copyright thereon in the United States, or of any piratical copies of any work copyrighted in the United States, is prohibited.

Sec. 31. That during the existence of the American copyright in any book the importation into the United States of any piratical copies thereof or of any copies thereof (although authorized by the author or proprietor) which have not been produced in accordance with the manufacturing provisions specified in section fifteen of this Act, or any plates

of the same not made from type set within the limits of the United States, or any copies thereof produced by lithographic or photo-engraving process not performed within the limits of the United States, in accordance with the provisions of section fifteen of this Act, shall be, and is hereby, prohibited: Provided, however, That, except as regards piratical copies, such prohibition shall not apply:

(a) To works in raised characters for the use of the blind;

(b) To a foreign newspaper or magazine, although containing matter copyrighted in the United States printed or reprinted by authority of the copyright proprietor, unless such newspaper or magazine contains also copyright matter printed or reprinted without such authorization;

(c) To the authorized edition of a book in a foreign language or languages of which only a translation into English has been copyrighted in this country.

(d) To any book published abroad with the authorization of the author or copyright proprietor when imported under the circumstances stated in one of the four subdivisions following, that is to say:

First. When imported, not more than one copy at one time, for individual use and not for sale; but such privilege of importation shall not extend to a foreign reprint of a book by an American author copyrighted in the United States;

Second: When imported by the authority or for the use of the United States;

Third. When imported, for use and not for sale, not more than one copy of any such book in any one invoice, in good faith, by or for any society or institution incorporated for educational, literary, philosophical, scientific, or religious purposes, or for the encouragement of the fine arts, or for any college, academy, school, or seminary of learning, or for any State, school, college, university, or free public library in the United States;

Fourth. When such books form parts of libraries or collections purchased en bloc for the use of societies, institutions, or libraries designated in the foregoing paragraph, or form parts of the libraries or personal baggage belonging to persons or families arriving from foreign countries and are not intended for sale:

Provided, That copies imported as above may not lawfully be used in any way to violate the rights of the proprietor of the American copyright or annul or limit the copyright protection secured by this Act, and such unlawful use shall be deemed an infringement of copyright.

* * * * * * * * * *

Sec. 41. That the copyright is distinct from the property in the material object copyrighted, and the sale or conveyance, by gift or otherwise, of the material object shall not of itself constitute a transfer of the copyright, nor shall the assignment of the copyright constitute a transfer of the title to the material object; but nothing in this Act shall be deemed to forbid, prevent, or restrict the transfer of any copy of a copyrighted work the possession of which has been lawfully obtained.

Sec. 42. That copyright secured under this or previous Acts of the United States may be assigned, granted, or mortgaged by an instrument in writing signed by the proprietor of the copyright, or may be bequeathed by will.

Sec. 43. That every assignment of copyright executed in a foreign country shall be acknowledged by the assignor before a consular officer or secretary of legation of the United States authorized by law to administer oaths or perform notarial acts. The certificate of such acknowledgment under the hand and official seal of such consular officer or secretary of legation shall be prima facie evidence of the execution of the instrument.

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Sec. 44. That every assignment of copyright shall be recorded in the copyright office within three calendar months after its execution in the United States or within six calendar months after its execution without the limits of the United States, in default of which it shall be void as against any subsequent purchaser or mortgagee for a valuable consideration, without notice, whose assignment has been duly recorded.

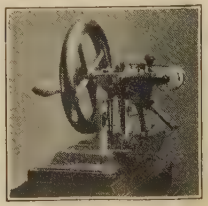
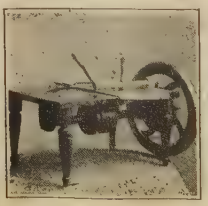
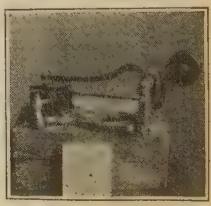
* * *

Sec. 46. That when an assignment of the copyright in a specified book or other work has been recorded the assignee may substitute his name for that of the assignor in the statutory notice of copyright prescribed by this Act.

Sec. 62. That in the interpretation and construction of this Act "the date of publication" shall in the case of a work of which copies are reproduced for sale or distribution be held to be the earliest date when copies of the first authorized edition were placed on sale, sold, or publicly distributed by the proprietor of the copyright or under his authority, and the word "author" shall include an employer in the case of works made for hire.

Sec. 63. That all laws or parts of laws in conflict with the provisions of this Act are hereby repealed, but nothing in this Act shall affect causes of action for infringement of copyright heretofore committed now pending in courts of the United States, or which may hereafter be instituted; but such causes shall be prosecuted to a conclusion in the manner heretofore provided by law.

Sec. 64. That this Act shall go into effect on the first day of July, nineteen hundred and nine.

EARLY TYPES OF SEWING MACHINES.

CHAPTER XIV.

ARMIES OF THE WORLD.

INFANTRY.

The real basis of the infantry organization of all foreign armies is the battalion. Except for England, the typical battalion is composed of 4 companies and has a strength on the war footing of some 20 to 25 officers and 900 to 1,100 men, counting from about 900 to 1,000 rifles. In England the battalion numbers 8 companies and counts about 860 rifles on the war footing.

In speaking of a foreign battalion it must, therefore, be borne in mind that its fighting strength is roughly equal to that of two of our battalions.

CAVALRY.

The basis of all foreign cavalry organization is the squadron. The foreign squadron numbers on a war footing from 120 to 150 sabers. Regiments contain from 3 to 6 squadrons.

It will therefore be noted that in speaking of a foreign squadron we mean a force of about one-half the strength of the United States squadron. Similarly, the cavalry regiment of foreign services is about one-half, or less, the strength of our regiments.

FIELD ARTILLERY.

The battery is usually taken as the unit of field artillery organization. For the purposes of comparison a more correct unit is the battalion.

Leaving Russia aside, it may be said that there are two great systems of field artillery organization. These may be called, naming them after their great exponents, the French and the German. The essential differences between these two systems may be summarized as follows:

The French system takes 4 guns as the firing unit, the battery, and assigns all of the ammunition which should be available *upon entry into action* to the battery; batteries count 5 officers, sometimes 4, and 170 men.

Under the German system the firing unit, battery, counts 6 guns, and only so much ammunition as is needed for the *immediate* service of the pieces is assigned to the batteries; the remainder of the ammunition which should be available *upon entry into action* being assembled in an ammunition battery (light ammunition column), which forms an *integral* part of the battalion.

In both systems the number of firing batteries in the battalion is three; the German system having an additional battery for ammunition gives that system 4 battery organizations to the battalion.

Under the German system the strength of firing batteries is about 5 officers and 150 men and that of ammunition batteries is 4 officers and 188 men. The strength of battalion staffs is not dependent upon the particular system.

FORTRESS ARTILLERY.

In most foreign services all artillery is on one list. That branch of artillery known as fortress artillery has no counterpart in our service. Fortress artillery garrisons the land fortresses of the country and furnishes artillery of various types to the mobile troops. The amount of mobile artillery which would be provided by the foot artillery in war is naturally dependent upon the character of the war, whether offensive or defensive, etc. It is, therefore, impossible to say by how much the artillery with the mobile troops, as shown in the tables, would be augmented in war.

COAST ARTILLERY.

The coast artillery shown for Germany does not give a correct idea, for many of the coast fortifications of that country are garrisoned by marines.

SANITARY TROOPS.

While the number of sanitary troops shown by the tables is small for foreign armies as compared with the number maintained by the United States, it should be borne in mind that in war much of the "bearer and first-aid duty" is performed in foreign services by men drawn from and forming part of the line. Furthermore, drivers for ambulances and for other non-technical purposes are drawn from the train. The necessity for maintaining a nucleus in peace for expansion in war does not therefore exist in the same degree in foreign countries as in the United States. Similar remarks are, however, true for services other than sanitary.

EXPANSION ON MOBILIZATION.

In all foreign countries of any consequence large numbers of *fully trained* reserves exist. These men are assigned to organizations, and in those organizations complete equipment of every kind and description is so stored as to facilitate immediate issue. Every horse in civil life has its place assigned and its owner is warned as to where it is to be turned in on mobilization; the same is true of vehicles. In the formation of certain classes of trains the Government simply directs teamsters with their teams, harness, and wagons to report at previously specified places. It is thus simply a matter of hours for the great powers to mobilize.

Inasmuch as the frontiers of possible enemies adjoin their own, and the functioning of the mobilization of those enemies is equally complete, all nations on the continent of Europe maintain their cavalry and horse artillery at practically war strength and station those arms on the frontiers to secure the few hours which are necessary for mobilization.

TABLE SHOWING PEACE STRENGTH, BY ARMS OF THE SERVICE.

ONLY OFFICERS AND MEN WITH THE COLORS ARE CONSIDERED.

Country.	Infantry.	Cavalry.	Field artillery.	Foot artillery.	Coast artillery.	Technical troops.	Train.	Sanitary troops.	Total peace strength.[1]
France[2]	379,640	75,510	76,419	4,446	7,246	18,020	10,520	6,123	634,638
Germany	404,765	73,368	69,735	24,673	2,000	26,708	8,038	6,615	634,320
Austria[3]	194,123	47,541	33,012	6,040	2,100	10,507	5,070	4,307	327,580
Russia	580,000	115,000	94,110	18,056	14,152	37,448	(?)	(?)	1,200,000
England[4]	151,261	20,716	34,649	628	14,965	9,096	6,772	5,069	255,438
Italy	167,000	24,000	27,000	7,000	5,000	11,000	2,500	3,729	288,409
Mexico	20,326	7,318	1,912	(?)	(?)	657	215	(?)	31,000–32,000
Japan	149,402	14,585	18,918	6,889		16,727	11,427	3,484	230,000
UNITED STATES.									
Regulars[5]	27,370	13,540	5,456	0	19,993	3,449	0	4,117	81,361
Organized militia	97,035	4,167	4,565	0	7,256	2,539	0	2,146	119,660
Total	124,405	17,707	10,021	0	27,249	5,988	0	6,263	201,021

[1] Includes miscellaneous organizations, staffs, school detachments, etc.
[2] Includes troops stationed in Algiers and Tunis and such colonial troops as are stationed in France.
[3] Common army only. For Landwehr, see study on Austria.
[4] Regular army only. Indian army, colonial forces, and territorial forces are mentioned in study on England. Territorial force (British Isles) numbers 315,408. Canadian permanent force and organized militia numbers 67,037.
[5] Based on Army List, 20 November, 1910. The Porto Rican Regiment is counted as infantry. Technical troops include Engineers and Signal Corps. 8,000 recruits included in total. 5,000 Philippine Scouts are not counted.

ARMIES OF THE MINOR POWERS.

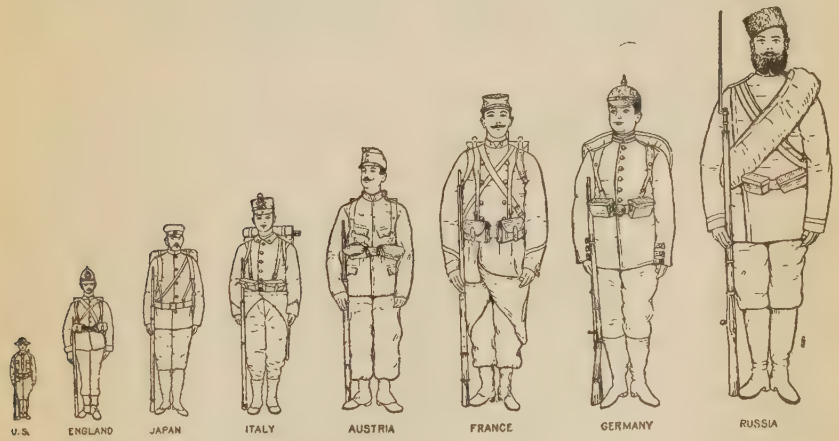
The number of men, peace and war footing, of the minor powers, is estimated as follows: Belgium, a peace footing of 47,000 men; war footing, 188,000; Bulgaria, peace footing, 57,800; war footing, 375,000; China, peace footing, 240,000 trained men; Denmark, peace footing, 12,000; war footing, 66,000; India (British), peace footing, 162,000; war footing, 220,000 (native troops only); Greece; peace footing, 20,000; war footing, 100,000; Holland, peace footing, 34,000; war footing, 175,000; Roumania, peace footing, 93,000; war footing, 350,000; Spain, peace footing, 115,000; war footing, 500,000; Sweden, peace footing, 69,000; war footing, 420,000; Switzerland, peace footing, 21,000; war footing, 270,000; Turkey, peace footing, 375,000; war footing, 1,000,000.

Table Showing Higher Organizations Existing in Time of Peace.

NO MILITIA, RESERVE, OR TERRITORIAL TROOPS ARE INCLUDED.

Country.	Army corps.	Divisions.	Cavalry divisions.	Infantry brigades.	Cavalry brigades.	Field-artillery brigades.
France	21	47	8	92	38	21
Germany	23	48	1	106	49	46
Austria [1]	16	33	5	58	19	16
Russia	31	56	23	143	[2] 46	61
England [3]	0	6	0	18	4	6
Italy	12	25	3	51	8	12
Mexico	0	0	0	0	0	0
Japan	0	19	0	39	2	3
United States	0	0	0	0	0	0

[1] Common army only.
[2] Possibly more.
[3] Figures are for regulars in the British Isles only. In addition there are 14 divisions, 42 infantry brigades, 14 field-artillery brigades, and 14 mounted brigades of territorial troops in the British Isles. In India there are 9 divisions, 9 field-artillery brigades, and 8 cavalry brigades.



INFANTRY OF PRINCIPAL NATIONS.

ARMIES OF THE LEADING POWERS.

AUSTRIA-HUNGARY.

The dual monarchy of Austria-Hungary maintains three separate armies supported by the Empire, by Austria, and by Hungary, respectively. These armies are known as the common army, the Austrian (Cisleithane) Landwehr, and the Hungarian Landwehr, respectively. The two Landwehr armies differ, however, from the Landwehr of other countries in that they are maintained with the colors in time of peace. The common army is known as the first line, and the two Landwehr armies as the second line.

In the common army there are 16 army corps with 33 divisions. There are 15 divisions in the Landwehr. There are 5 cavalry divisions organized in peace; they are attached to the army corps and all belong to the common army. The common army has 58 brigades of infantry and 19 brigades of cavalry. In the Landwehr there are 30 brigades of infantry and probably 6 of cavalry. There are 16 brigades of field artillery in the common army, organized in peace.

The total peace strength of the common army and the Landwehr comprises 31,328 officers, including a certain number of officials classed as officers, and 363,919 men. It is impossible to give any definite accurate statements as to Austria's maximum mobilization or even as to her initial mobilization. A conservative estimate, however, places the

number of fully trained men subject to call at about 2,000,000. Assuming that the *initial* mobilization would be confined to raising existing organizations to a war footing we would have the following fighting strength of the three armies: Common army: 420,300 infantry rifles; 1,854 field guns; 37,800 cavalry sabres. Landwehr: 192,850 infantry rifles; 96 field guns; 15,150 cavalry sabres.

Service is compulsory between the ages of 19 and 42, and is divided into numerous categories. The most important of these are as follows: Common army, 3 years with the colors and 7 years with the first reserve; during the latter period the men are subject to call for three periods of training of 4 weeks each. Landwehr, 2 years with the colors and 10 years with the first reserve; during the latter period the men may be called for instruction under varying and complex rules.

ENGLAND.

The military forces of England fall under several categories. The principal of these are: The regular forces, and the territorial forces. The regular forces are again divided into British forces—Indian forces and colonial forces. In addition, certain of the colonies, Canada, for example, maintain considerable forces of militia.

The British forces (regular) within the British Islands are organized into 6 divisions and 4 cavalry brigades. The territorial force has 14 divisions (similar to those of the regulars) and 14 mounted brigades. The forces in India, including regular and native, are divided into two armies, containing a total of 9 divisions and 8 cavalry brigades. The division in India is smaller than is usually the rule (about 13,000).

The total peace strength of the regular army comprises 255,438 officers and men, distributed as follows: British Isles, 134,339 officers and men; Colonies (other than India), 45,215 officers and men; India, 75,884 officers and men. In addition there are 190 officers and 1,198 men employed with the special reserves, of whom there are 86,539. There are also 138,000 men in the army reserve, in addition to the special reserve. Combining the strength of the forces with the colors and the trained reserves, we have as the *trained* force which England is able to mobilize as her *Regular Establishment* a total of 481,365 officers and men. Service in the regular establishment is voluntary and the period of enlistment is usually for 12 years, of which a certain portion is passed with the colors and the remainder in the reserve. Service with the colors is usually 3, 7 or 8 years, depending

TABLE SHOWING PERCENTAGES OF SEVERAL ARMS OF TOTAL PEACE STRENGTH.

Country.	Infantry.	Cavalry.	Field artillery.	Foot artillery.	Coast artillery.	Technical troops.	Train.	Sanitary troops.	Miscellaneous.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
France	59.77	11.89	12.05	0.70	1.14	2.83	1.65	0.96	9.01
Germany	63.81	11.56	10.99	3.88	.33	4.21	1.26	1.04	2.02
Austria	59.34	14.51	10.07	1.84	.64	3.20	1.54	1.31	7.55
Russia	48.33	9.58	7.84	1.50	1.17	3.12	(?)	(?)	28.46
England	59.21	8.10	13.56	.24	5.85	3.56	2.65	1.98	4.85
Italy	57.90	8.32	9.36	2.42	1.73	3.81	.86	1.29	14.31
Mexico	63.50	22.86	5.97	(?)	(?)	2.05	.37	(?)	5.25
Japan	64.95	6.34	8.22	2.99		7.27	4.96	1.51	3.76
UNITED STATES.									
Regulars	33.64	16.64	6.66	0	24.57	4.23	0	5.06	9.20
Organized Militia	81.09	3.48	3.81	0	6.06	2.12	0	1.79	1.65
Total	61.70	8.80	5.07	0	13.55	2.97	0	3.11	4.80

CAVALRY OF PRINCIPAL NATIONS.

on the arm of the service and other conditions.

There is also the territorial force, which however, does not serve beyond the limits of the British Isles, except by its own consent. The total of this territorial force is about 315,408.

All the colonies maintain bodies of native troops. India has a native force of some 162,000 men. The Canadian forces are divided into the permanent and active militia; the combined peace strength of these two forces as authorized by law being 62,037 for the active militia and 5,000 for the permanent force. Actually, the numbers are somewhat below these figures as follows: Infantry, 43,162 officers and men; field artillery, 3,719; garrison artillery, 2,993; cavalry, 8,567, a total of 58,441 officers and men. In addition there are in Canada reserves, under various names, to the number of 39,346. The Canadian forces are probably about as well trained as the Organized Militia of the United States.

FRANCE.

The French Army proper is known as the Metropolitan Army and is divided between France and Algiers. There are 20 army corps organized in peace. In addition there is one colonial army corps. There are 47 divisions and 92 infantry brigades; 21 field artillery brigades are distributed among the 21 corps. There are also 8 cavalry divisions organized in peace, or a total of 38 cavalry brigades.

The total peace strength of the French Army, exclusive of colonial troops but including gendarmes and "republican guards," comprises 29,209 officers and 577,303 men. Of these 26,368 officers and 507,764 men are stationed in France. There are in addition, 2,083 officers and 26,043 men of the colonial army stationed in France. This brings the total force stationed in France up to 28,451 officers and 533,807 men. The grand total of the Metropolitan Army and the colonial

(Continued on page 396.)

TABLE SHOWING FIGHTING STRENGTH OF THREE ARMS ON MOBILIZATION.

EXISTING ORGANIZATIONS ONLY CONSIDERED.

Country.	Infantry rifles.	Cavalry sabers.	Field guns.	Sabers per thousand infantry bayonets.	Field guns per thousand infantry bayonets.[1]	Fully trained reserves available for passing from peace to war footing.
France [2]	618,450	66,750	2,936	107.93	4.74	2,300,000
Germany	633,000	76,500	3,866	120.85	6.10	4,000,000
Austria [3]	420,300	37,800	1,854	89.93	4.41	1,600,000
Russia [4]	973,152	111,825	4,432	114.91	4.55	3,800,000
England [5]	135,020	15,000	1,170	111.09	8.66	215,000
Italy	300,000	20,880	1,470	69.99	4.90	1,250,000
Mexico [6]	53,760	14,016	176	260.71	3.27	None.
Japan [7]	228,000	14,550	954	63.81	4.18	1,000,000
UNITED STATES.						
Regulars [8]	39,600	15,225	144	384.46	3.63	None.
Organized Militia [9]	167,000	5,800	200	34.73	1.19	None.
Total [10]	206,600	21,025	344	101.76	1.66	None.

[1] No deductions made for horse guns.

[2] For all existing units, for mobilization in France, see separate study.

[3] Common army only. Figures are approximate. (See study.)

[4] The peculiar situation of Russia makes it impossible for her to assemble her total force upon any one theater of war.

[5] Regulars only. For territorial forces, extra reserves, etc., see study.

[6] Total strength in ranks considered. The deductions which should be made for noncombatants are not accurately known. Laws for compulsory service exist and might be put into effect in war.

[7] Japan forms a very large number of new organizations which are not considered here. Neither are the special troops in Formosa and elsewhere considered. The foot artillery mobilizes an additional number of heavy field guns, possibly 1 gun per thousand rifles.

[8] Porto Rican Regiment and Philippine Scouts are excluded from this table.

[9] The infantry in the Organized Militia is obtained by reducing all incomplete regiments to the standard organizations. Separate companies and cadet corps, etc., have not been considered.

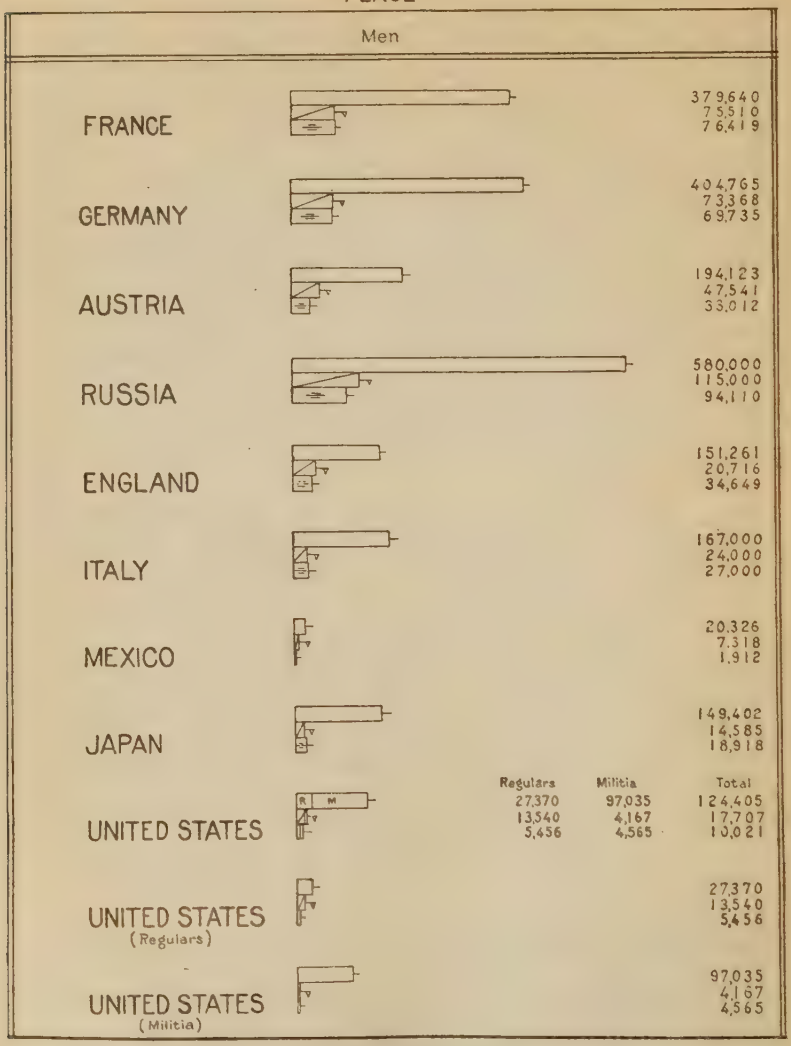
The Organized Militia has no complete regiments of Cavalry. The figures are obtained by multiplying the number of troops by the troop fighting strength.

All batteries of the Organized Militia are included, although 6 batteries (24 guns) have not yet reached the stage where it is deemed expedient to issue modern material. Only a few batteries are organized into complete battalions and there are no regiments.

[10] This assumes that organizations can be raised to the war strength. As a matter of fact trained men are not available for this purpose, and if they were clothing and equipments are not available for passing to the war strength.

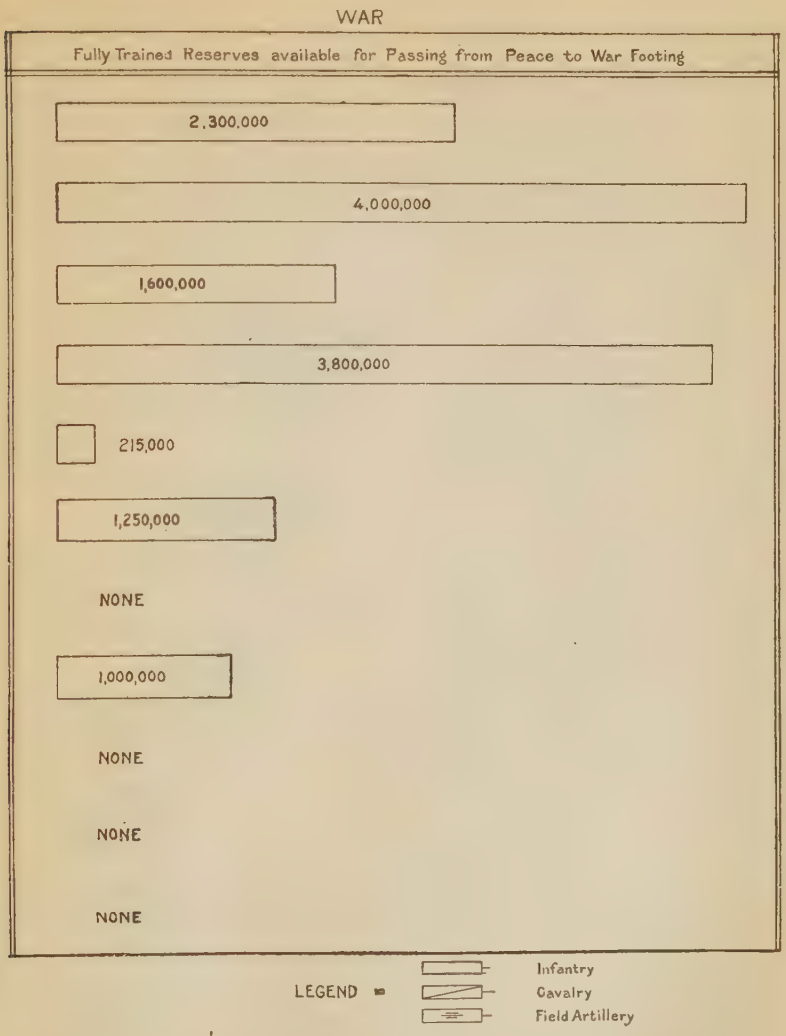
PEACE

Men



The relative rank between the officers of the United States army and navy is as follows: General with Admiral; Lieutenant-General with Vice-Admiral; Major-General with Rear-Admiral; Brigadier-General with Commodore; Colonel with Captain; Lieutenant-Colonel with Commander; Major with Lieutenant-Commander; Captain with Lieutenant; First Lieutenant with Lieutenant (junior grade); Second Lieutenant with Ensign.

At the close of the fiscal year ending June 30, 1911, the number of sea coast guns in the United States mounted, ready for armament and under construction, were as follows. Guns mounted: 376 12-inch mortars; 105 12-inch guns, including 2 guns on hydraulic lifts; 133 10-inch guns; 65 8-inch guns; 503 rapid fire guns, one mounted temporarily. Ready for Armament: 2 12-inch guns and 13 rapid fire guns.



GUN SALUTES.

President of the United States, President of a Foreign Republic, Member of Royal Family and Ex-President of the United States, 21 guns; Vice-President of the United States and Ambassador of United States (in waters of country to which he is accredited), 19 guns; Secretary of the Navy, Cabinet Officer, Chief Justice, Governor-General of U. S. Islands, Governor of State, Territory, or U. S. Islands, President *pro tempore* of Senate, Speaker of House of Representatives, Committee of Congress, Admiral of the Navy and General, 17 guns; Assistant Secretary of the Navy, Envoy Extraordinary, Vice-Admiral and Lieutenant-General, 15 guns; Minister Resident, or Diplomatic Representative, Rear-Admiral and Major-General, United States Army, 13 guns; Charge d'Affaires and Commodore, 11 guns; Consul-General, 9 guns; Consul, 7 guns; Vice-Consul, 5 guns.

(Continued from page 393.)

troops stationed in France is 31,292 officers and 603,364 men.

The organization of the maximum mobilization of France cannot be given with any degree of accuracy but it is estimated that the sum total of all trained men which she is able to mobilize amounts to about 3,000,000 men. The fighting strength of the three arms on *initial* mobilization would be about 518,000 infantry rifles, 59,250 cavalry sabres and 2,944 field guns. This estimate is a minimum.

Besides the above, there are about 49,500 colonial troops. About 14,500 of these are Europeans and the remainder natives. There are also about 3,723 Europeans and 8,254 natives in the forces at Madagascar.

Service with the Metropolitan Army is compulsory between the ages of 20 and 45. After serving with the colors for two years (all arms) the men pass into the reserve of the active army, in which they serve for 11 years, during which they are subject to two periods of instruction, one for 23 days, the other for 17 days. From the reserve of the active army the men pass to the "territorial army," in which they serve for 6 years, subject to one period of 7 days' instruction. The final service is with the "reserve of the territorial army"; this service is for 6 years; the men receive no training but are subject to muster.

GERMANY.

The German Army as now organized in peace consists of 23 army corps and 1 cavalry division, besides certain special troops, schools, recruiting stations, etc. While the cavalry divisions which would mobilize in war are not all formed in peace, there exist certain staffs for such divisions and they are assembled for instruction from time to time.

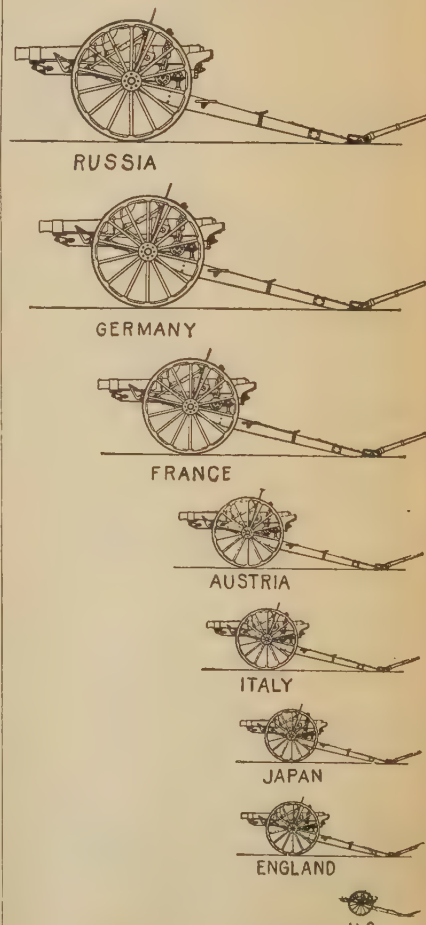
The total peace strength amounts to 622,320 officers and men. To these should be added from 10 to 12 thousand "Einjahrig-freiwilligers." These men serve for one year defraying their own expenses. The sum total of *trained* men which Germany is able to mobilize amounts to about 4,610,000. The estimated fighting strength of her *initial* mobilization is as follows: 962,000 infantry rifles; 79,200 cavalry sabres; 5,226 field guns. No German troops of the army proper serve outside the home country in time of peace. An estimate of the number of colonial troops places the number at 10,000 officers and men.

Service in the German army is compulsory between the ages of 17 and 45 and is divided into a number of categories. Service with the colors is three years with the cavalry and horse artillery and two years for other arms. After serving with the colors, the men pass into the reserve, in which they serve 4 years and 6 months or 5 years and 6 months according to the arm of the service. During this service the men of the reserve may be called out for two periods of training of 8 weeks each. In practice the majority of the reserve is seldom held longer than 28 days for each period. From the reserve the men pass into various other categories. Germany has more men annually arriving at the age of military service than she needs for duty with the colors. Somewhat over one million men annually present themselves, of whom a little more than 250,000 are actually drafted for duty with the colors.

ITALY.

The Italian military system is complicated and is composed of the regular army, the mobile militia, and the territorial militia. The regular army as reorganized in 1910 comprises 12 army corps, 25 divisions, and 3 cavalry divisions in time of peace. Commanders and staffs for four armies exist in time of peace.

The total peace strength of the regular army in 1909-1910 was 13,942 officers and 274,467 men, but it is doubtful if more than 250,000 men were actually with the colors at any one time. On paper the number of men Italy would be able to mobilize amounts to



ARTILLERY OF PRINCIPAL NATIONS.

about 3,500,000 men. A conservative estimate would seem to be about 1,500,000 *fully trained* men. The complex system and the custom of giving indefinite leave to untrained men render it difficult to estimate Italy's strength accurately with respect to the number of fully trained men. The fighting strength of the three arms on *initial* mobilization would be: Infantry rifles, 300,000; cavalry sabres, 20,880; field guns (with probably an additional 162 heavy field guns manned by fortress artillery) 1,470. In addition, Italy maintains in her African possessions 132 officers and 4,530 trained men; of the latter 660 are Italians and the remainder natives.

Service is compulsory between the ages of 20 and 39. Service with the colors is nominally for 3 years, but as the budget is seldom sufficient many men are released with one or two years' training. These pass from the colors to a form of leave status in which they serve to complete a total period in the regular army of 8 or 9 years. They then pass into the mobile militia, from whence they go into the territorial militia. The men are subject to the call for instruction as follows: 30 days per year for the leave status and mobile militia; 30 days in 4 years for the territorial militia.

MEXICO.

There is no organization higher than the regiment in time of peace. The total peace strength is between 31,000 and 32,000. Mexico's war strength, aside from new organizations, may be reckoned at about 100,000 officers and men. In theory, service is compulsory. Actually, it is not, except, perhaps, for some of the lower and criminal classes.

JAPAN.

The rapid progress of Japan as a military nation, the secrecy maintained by her concerning reserves, territorial organizations, etc., as well as the system of training Japanese school children in the rudiments of drill and military discipline, makes it extremely difficult to make an accurate inventory of the Japanese military resources.

The division is the highest permanent organization in time of peace. There are, however, 11 generals and 22 lieutenant-generals, besides other officers, available for the command and staff of such armies as may be formed in war. There are 19 divisions organized in peace. There are 39 brigades, 4 cavalry brigades and 3 field artillery brigades. In addition there is one infantry brigade in Korea.

The peace strength of Japan is variously estimated and it is certain that it is *at least* 230,000 men. The fighting strength of the three arms follows: Infantry rifles, 228,000; cavalry sabres, 14,550; field guns (with possibly 228 heavy field guns in addition) 954. There are at least 1,000,000 *fully trained* reserves subject to call on mobilization.

RUSSIA.

It is difficult to make an entirely satisfactory résumé of the Russian Army due to the vast extent of Russia's territory, the internal condition of the nation, and the character of the countries adjoining her which make it necessary for her to maintain what amounts to three separate armies, namely, the Army of Europe and the Caucasus; the Army of Central Asia; the Army of Siberia and Eastern Asia. Then the troops are divided up into numerous categories, some of which are most unusual and about which there is little information that can be depended upon. For example, we find "active troops," "reserve troops," "2d reserve troops," and "fortress troops."

There are 31 army corps, with 56 divisions organized in peace, and 23 cavalry divisions. The total peace strength amounts to about 1,200,000 officers and men. The total number of trained men subject to call amounts to about 5,000,000. It is estimated that Russia could mobilize 2,000,000 *fully trained* men upon her European frontiers.

Military service in Russia is obligatory. Passing from service with the colors the men pass into various reserves but on account of their great variety no further statements can be given in a brief form.

THE UNITED STATES ARMY.

The United States Army consists, ordinarily, of the Regular Army but whenever the United States is invaded or is in danger of invasion from any foreign nation, or of rebellion against the authority of the Government of the United States, or the President is unable with the regular forces at his command to execute the laws of the Union, he may call into the military service of the United States, all or any part of the Organized Militia of the various States and the District of Columbia. In war, or when war is imminent, the Army of the United States, after the Organized Militia has been called into service, may be further augmented by the employment of volunteers.

Under the Act of Congress approved Feb. 14, 1908, the system of military control in the Army was reorganized. This act abolished the separate office of commanding general of the army and created the General Staff Corps, which under the direction of the Chief of Staff, is charged with the following duties: To investigate and report on all questions affecting the efficiency of the Army and its state of preparation for military operations; to prepare projects for maneuvers; revises estimates for appropriations for the support of the Army and advises as to the disbursement of such appropriations; exercises supervision over inspections, military education and instruction, etc. and to perform such other military duties not otherwise assigned by law, as may from time to time be prescribed by the President.

On May 26, 1911, a general order of the War Department was issued by which the office of Chief of Staff was divided into four sections. 1. The Mobile Army. 2. The Coast Artillery Division. 3. The Division of Militia Affairs. 4. The Army War College.

The command of the Army rests with the constitutional commander-in-chief, the President, who may place all or part of the Army under commands subordinate to his general command. We have had but four

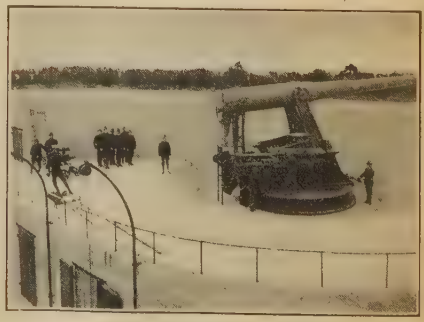
generals—Washington, Grant, Sherman and Sheridan. A General is supposed to command an army. An army is a large and organized body of soldiers, generally composed of infantry, cavalry and artillery, completely armed and provided with necessary stores, etc., and the entire force is under the direction of one general. The subdivision of the United States Army follows. An "army" is divided into two or more field armies, or corps, commanded by a Lieutenant-General. A "corps" is the largest tactical unit of a large army and is really a small army complete in itself in that it is usually organized with separate staff, infantry, cavalry and artillery regiments as well as auxiliary services. A "corps" is also any body or department of an army which is not detached but has its own organization and head, as the "Corps of Engineers," the "Signal Corps," etc. A corps is composed of two or more divisions, each under the command of a Major-General. Each "division" is composed of three brigades of infantry, a regiment of cavalry and a brigade (two regiments) of field artillery. The division is the great administrative and tactical unit and forms the basis of army organization. A "brigade" consists of three regiments of infantry and is commanded by a Brigadier-General. A cavalry brigade consists of two or more cavalry regiments. When acting independently, a regiment of horse artillery is attached to a cavalry brigade. A "regiment" which is both administrative and tactical is commanded by a Colonel and is divided into 12 companies. (The regiment at Porto Rico is composed of but 8 companies.) A regiment of cavalry is composed of 12 troops and a regiment of field artillery of 6 batteries. Two or more companies form a "battalion" commanded by a Major. The battalion is a tactical unit only. A "company," which is commanded by a Captain, is both administrative and tactical. Under the present law the number of enlisted men in a company, troop, etc., varies with the station, as follows: Philippine Islands, infantry 150 men, cavalry 100 men; Hawaii and Panama Canal Zone, infantry 72 men, cavalry 70 men; all companies not stationed as above, infantry 65 men, cavalry 65 men. There are 133 men in a battery of light and mountain artillery and 150 men in a battery of horse artillery. Each company of Coast Artillery consists of 104 enlisted men and each company of engineers of 159 men.

The Regular Army is officered: 1. By Graduates of the United States Military Academy. 2. By promotion of meritorious enlisted men of the army whose fitness for advancement is determined by a competitive examination. 3. By the appointment of civilians selected from the best cadet schools of the country

The pay of officers in active service of the United States Army is as follows: Lieutenant-General, $11,000; Major-General, $8,000; Brigadier-General, $6,000; Colonel, $4,000; Lieutenant-Colonel, $3,500; Major, $3,000; Captain, $2,400; First Lieutenant, $2,000; Second Lieutenant, $1,700. Officers below the rank of Brigadier-General receive ten per cent. on the yearly pay of the grade for each term of five years' service, not to exceed 40 per cent. in all. Thus the maximum pay of the Colonel is $5,000; Lieutenant-Colonel, $4,500, etc. Further, any officer below the rank of major required to be mounted receives $150 per annum additional if he provides one suitable mount at his own expense, and $200 if he provides two mounts. Furthermore, all officers serving outside of the United States except Porto Rico and Hawaii, receive ten per cent. increase in pay while so serving. The monthly pay of a private in artillery, cavalry, infantry and signal corps is $15 for the first enlistment, $18 for the second enlistment, etc., up to $25 for the seventh enlistment.

The active strength of the army on December 1, 1911, including the Philippine Scouts was 4,847 officers and 77,523 enlisted men, a total of 82,370. This total of 82,370 was made up as follows: Infantry (31 regiments) 1,655 officers and 27,583 enlisted men; cavalry (15 regiments) 816 officers and 13,286 enlisted men; field artillery (6 regiments) 261 officers and 5,416 enlisted men; coast artillery corps (170 companies) 740 officers

LOADING A DISAPPEARING GUN, WHEN IT IS IN THE DEPRESSED POSITION.



FIRING A 12-INCH DISAPPEARING GUN AT ONE OF OUR COAST BATTERIES.

and 18,471 enlisted men; corps of engineers (3 battalions) 200 officers and 1,942 enlisted men; signal corps, 46 officers and 1,212 enlisted men; 7,904 enlisted men not detached to regiments; staff corps, Quartermaster's, Medical, Pay, Subsistence and Ordnance Departments, Military Academy, Bureau of Insular Affairs and Indian Scouts, 1,129 officers and 1,709 enlisted men. In addition to the above there were 3,500 enlisted men in the Hospital Corps (not counted as enlisted men by law) and 628 cadets of the Military Academy (entered under law, see Military Academy), making a grand total of 86,498 officers and men. There were on the retired list 1,013 officers and 3,317 enlisted men.

The term of enlistment in the regular service is three years. Any male citizen of the United States between the ages of 21 and 35 may be enlisted. Minors between the ages of 18 and 21 may be enlisted only with the consent of parents or guardians. All applicants must be able to read and write English, must be able-bodied, free from disease and of good character and temperate habits.

Under the Act of Congress of January 31, 1903, amended May 27, 1908, the militia consists of every able-bodied male citizen of the United States who is more than eighteen and less than forty-five years of age, and is divided into two classes—the organized militia or National Guard, and the remainder to be known as the reserve militia. It is entirely optional whether eligible citizens join the National Guard, but it is safe to say that this body of reserves is recruited from the best and most patriotic element of the population of the United States. Congress makes an appropriation each year for the support of the militia in the various States, and the States also contribute, hold and build armories, as the regiments are really intended to defend their own State primarily, although in time of war they furnish an excellently drilled body of volunteers. In nearly every city of any great size there is one or more armories, and in the smaller cities and towns there are separate companies which have armories or drill halls. The militia in each state is divided into brigades, regiments, battalions and companies. Under the act of Congress above named the President of the United States has the power to call upon any of the military organizations of the States for national defense and when so called each man must yield prompt obedience to the order to escape trial by court-martial. The Organized Militia is, in short, subject to be ordered at any time into the service of the United States as a re-enforcement of the regular army and when so ordered are subject to the same rules and regulations as the regulars and receive the same pay, during service, as the regular army troops.

The strength of the organized militia, according to the latest report is 9,172 officers and 108,816 enlisted men, as follows: General officers and General Staff 2,051; engineers, 1,141 officers and men; cavalry, 4,226 officers and men; field artillery, 4,453; coast artillery, 7,100 officers and men; infantry, 95,356 officers and men; hospital corps, 2,281 officers and men; signal corps, 1,380 officers and men; grand aggregate, 117,988 officers and men.

The officers of higher grades are appointed by the Governor but the other officers, from Colonel down, are generally selected by ballot by the troops themselves.

The term of enlistment varies in different States from one to five years but in most States it is three years. In addition the term of re-enlistment also varies; some States provide for a certain term for the first enlistment and a smaller term of enlistment in subsequent enlistments.

The total number of males of militia age in the United States in 1910 was 20,473,684. The officers of all the volunteer forces which may be organized under the authority of Congress are selected from the following classes of persons: 1. Those who have served in the Regular Army. 2. Those who have served in any volunteer forces of the Organized Militia. 3. Those who have attended a military school or college.

CIVIL WAR STATISTICS.

The total number of enlistments in the army, navy and marine corps, during the Civil War, totaled 2,778,304 as follows: White troops of army, 2,493,366; sailors and marines, 105,963; negro troops, 178,975. Many men enlisted two or three times and are counted that number of times in the above rating. New York had 404,805 white troops, 4,125 negro troops and 39,920 sailors and marines; Pennsylvania had 315,017 whites, 8,612 negroes and 14,307 sailors and marines; Ohio had 304,814 whites, 5,092 negroes and 3,274 sailors and marines; Illinois had 255,057 whites, 1,811 negroes and 2,224 sailors and marines; Massachusetts had 122,781 whites, 3,966 negroes and 19,983 sailors and marines. Kentucky had the greatest number of negro troops, 23,703.

During the Civil War there were 4,142 officers and 62,916 enlisted men killed in action; 2,223 officers and 40,789 enlisted men who died of wounds received in action; 2,795 officers and 221,791 enlisted men died of disease; 106 officers and 4,838 enlisted men drowned; other known causes 290 officers and 7,472 enlisted men; causes not stated, 28 officers and 12,093 enlisted men, making a grand total of 9,584 officers and 349,944 enlisted men killed during the Civil War.

At the close of the fiscal year ending June 30, 1911, there were 154 garrisoned posts in continental United States, Alaska, Hawaii Islands and Porto Rico. United States: 91 forts, 27 sub-posts of forts, 11 barracks, 5 arsenals, 2 military prisons (Alcatraz, Cal. and Ft. Leavenworth, Kans.), 3 general hospitals and the Springfield Armory, and 1 barrack. There were also 5 forts in Alaska: the Henry Barracks and the post at San Juan, Porto Rico; and the post at Panama Canal Zone.

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THE SINEWS OF WAR.

Ten days' rations of the American Army, compared with a locomotive and one of the 70,000 units that consume this enormous quantity of food. Only one of the meats or fish shown enter into the calculation, the rest represent the variety from which the soldier can make his choice.

THE UNITED STATES MILITARY ACADEMY.

Appointments: Each congressional district and Territory—the District of Columbia and also Porto Rico—is entitled to have one cadet at the academy. Each State is also entitled to have two cadets from the State at large, and 40 are allowed from the United States at large. The law, however, provides that for six years, from July 1, 1910, whenever any cadet shall have finished three years of his course at the academy his successor may be admitted. The appointment from a congressional district is made upon the recommendation of the Representative in Congress from that district, and those from a state at large upon the recommendation of the Senators of the State. Similarly the appointment from a Territory is made upon recommendation of the Delegate in Congress and that from the District of Columbia upon the recommendation of the Commissioners of the District. Each person appointed must be an actual resident of the State, District, or Territory from which the appointment is made. The appointments from the United States at large are made by the President of the United States. Appointments are required by law to be made one year in advance of the date of admission, except in cases where by reason of death or other cause, a vacancy occurs which cannot be provided for by such appointment in advance. These vacancies are filled in time for the next examination. Two alternates are usually named for each candidate nominated and the alternate making the highest average is entitled to admission in case of the failure of the candidate.

Examinations: Examinations are held on the last Tuesday in April of each year before a board of army officers to be convened at such places as the War Department may designate. Candidates must appear for the physical and mental examination before such board.

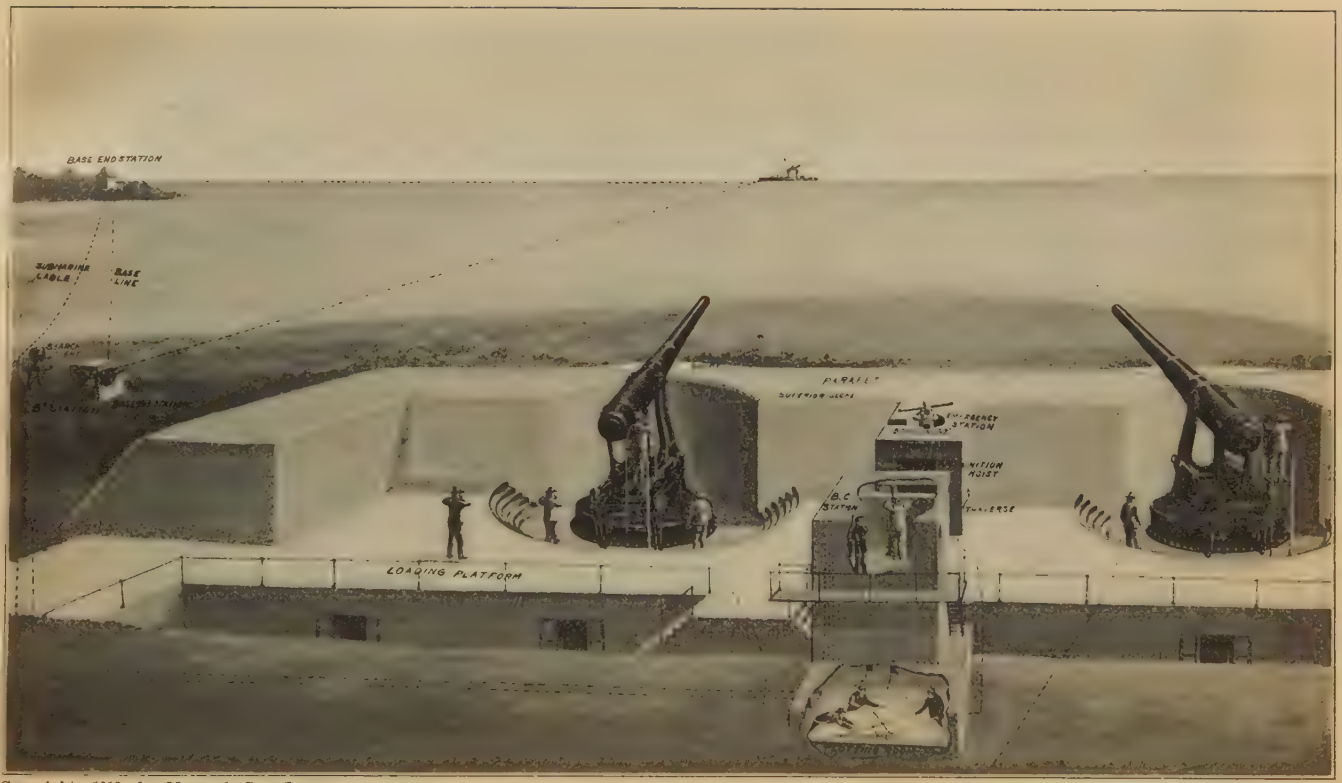
No candidate is admitted who is under 17 or over 22 years of age or less than 5′ 4″ in height at the age of 17, 5′ 5″ at the age of 18 and upward, or who is deformed, or afflicted with any disease or infirmity which would render him unfit for military service.

Pay: The pay of a cadet is $600 per year and one ration per day, the total being $709.50. No cadet is permitted to receive money or any other supplies from home without the sanction of the superintendent.

After graduation a cadet may be promoted and commissioned to the grade of second lieutenant in any arm or corps of the Army in which there may be a vacancy and if there is no vacancy he may be commissioned as an additional second lieutenant, with the nominal pay of a second lieutenant, until a vacancy occurs.

THE NEW ARMY GUN FOR AIR-CRAFT.

RANGE FINDING TOWER.



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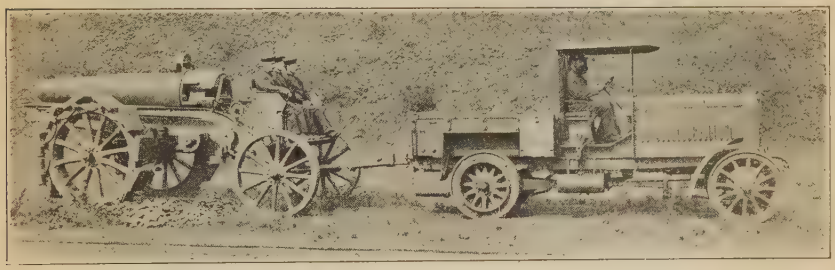
TYPICAL VIEW OF A COAST-DEFENSE BATTERY.

Observers at Stations B^1 and B^2, which may be a mile or more apart, note the angles made by the lines to enemy's ship and the base line. These angles are telephoned to the plotting room, where the exact position of the ship and the corresponding elevation for the guns are determined. This elevation corrected for wind, tide, etc., is telephoned to the guns.

THE MONROE DOCTRINE.

The Monroe Doctrine was formulated by President Monroe in 1823, in agreement with Great Britain and in opposition to the designs of the Holy Alliance, which contemplated the partition of South America among the European Powers. President Monroe said:

"In the discussions to which this interest has given rise, and in the arrangements by which they may terminate, the occasion has been judged proper for asserting as a principle in which the rights and interests of the United States are involved, that the American continents, by the free and independent condition which they have assumed and maintain, are henceforth not to be considered as subjects for future colonization by European Powers. * * * We owe it, therefore, to candor and to the amicable relations existing between the United States and those powers to declare that we should consider any attempt on their part to extend their system to any portion of this hemisphere as dangerous to our peace and safety. With the existing colonies or dependencies of any European Power we have not interfered and shall not interfere. But with the governments who have declared their independence and maintain it, and whose independence we have on great consideration and on just principles acknowledged, we could not view any interposition for the purpose of oppressing them or controlling in any other manner their destiny, by any European power, in any other light than as the manifestation of an unfriendly disposition toward the United States.



THE MORTAR ON ITS CARRIAGE HAULED BY AN AUTOMOBILE. THE LATTER CARRIES THE AMMUNITION.

DEPARTMENT OF WAR.

The Secretary of War is the head of the War Department and exercises personal supervision of all business relating to the military service. He performs such duties as are required of him by law or may be enjoined upon him by the President, and directs the management of all the bureaus, divisions and officers embraced in the department. Has supervision of the United States Military Academy at West Point and of military education in the Army.

The principal duties of the General Staff Corps are given under the United States Army, page 397.

DIVISION OF MILITIA AFFAIRS.

The Division of Militia Affairs is vested with the transaction of business pertaining to the organized and unorganized militia of the United States, its jurisdiction embracing all administrative duties involving the armament, equipment, discipline, training, education and organization of the militia.

MILITARY BUREAUS.

The Adjutant General is charged with the duty of recording, authenticating, and communicating to troops and individuals in the military service all orders, instructions, and regulations issued by the Secretary of War; of managing the recruiting service; pension and other business connected with the Volunteer Armies.

The Inspector-General inspects all military commands and stations, schools, fortifications, arsenals, armories, etc., under charge of or carried on by officers of the Army.

The Quartermaster-General provides transportation for the Army; also clothing and equipage, horses, mules, etc., for the Army and militia; pays guides, spies and interpreters; is in charge of national cemeteries.

The Corps of Engineers is charged with duties relating to the construction and repair of fortifications, works of defense, military roads and bridges, etc.

The Ordnance Department provides, preserves, distributes, and accounts for every description of artillery, small arms and all the munitions of war which may be required for the fortresses of the country, the armies in the field, and the whole body of militia.

The Chief Signal Corps Officer is charged with the supervision of all military signal duties, including telegraph and telephone apparatus and the necessary meteorological instruments for use on target ranges and other military uses, and all other duties pertaining to military signaling, including aeroplanes.

THE MEDALS OF THE ARMY AND NAVY.

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THE MEDALS OF THE ARMY AND NAVY.

THE MEDALS OF THE ARMY AND NAVY.

MEDALS OF HONOR.

The Medal of Honor for the Navy (No. 2), which was made available by the Act of Congress, approved December 21, 1861, is bestowed upon such petty officers, seamen, landsmen and marines as should distinguish themselves by their gallantry in action or other seamanlike qualities, during war. It consists of a bronze five-pointed star, the points terminating in trefoil with a wreath of oak and laurel contained in each ray. In the center, within a circle of thirty-four stars, America is represented as Minerva vanquishing Discord. The star is mounted on an anchor and suspended from a silk ribbon of red and white stripes, arranged vertically below a field of blue.

The Medal of Honor for the Army (No. 9) is made in silver, heavily electro-plated in gold. It consists of a five-pointed star and in the center appears the head of Minerva. Surrounding this central feature, arranged in circular form, are the words "United States of America," representing nationality. The medal is suspended by a light blue watered-silk ribbon spangled with thirteen white stars representing the original States, and is attached to an eagle clasp supported on a horizontal bar, upon which appears the word "Valor."

GOOD CONDUCT MEDALS.

There are many men in the Naval Service, although they may never have attracted sufficient attention to warrant the Medal of Honor, who are well worthy of recognition by virtue of their long and faithful service; for these thoroughly efficient sailors there is also a reward known as the Good Conduct Medal. The first issue of this Medal was in 1870 (No. 23). This was recalled in 1888, and the present style adopted (No. 18). In the center of the new Medal is an old warship with the word "Constitution" beneath. This is suspended by a red ribbon.

In 1910 a Medal similar to that of the Navy was adopted by the Marine Corps for the reward of Good Conduct in the service (No. 17), except that there was a slight change made in the central figure and a change in the wording to suit this corps.

BADGES FOR PROFICIENCY IN SMALL ARMS PRACTICE.

For proficiency in the annual practice with rifles and revolvers the Army and Marine Corps award a similar set of distinguishing badges. In rifle practice the first badge is that of Marksman (No. 15), which requires the qualifying of the participant with 60 per cent., for slow, rapid and skirmish fire at 200, 300, 500 and 600 yards. The Sharpshooter's Badge (No. 13) is presented to those who qualify with a similar percentage at 800 and 1,000 yards (slow fire) and rapid fire at 500 yards. For the Expert Rifleman's Badge (No. 14) the candidate must secure 68 per cent. at slow, timed and skirmish fire at 200, 300, 600 and 1,000 yards.

In the Navy the grades are corresponding, although shorter, and include revolver practice as well. The Navy issues but one Medal (No. 16), the Sharpshooter's Medal, to which bars are attached for further distinction.

SPECIAL LEGENDS.

The Certificate of Merit Badge (No. 11); issued to officers and men of the Army for meritorious service. The ribbon is composed of two bands of red, white and blue, separated by a narrow white stripe.

The Philippine Congressional Medal (No. 5); issued to volunteer officers and men who served beyond their enlistment with the Army in the Philippines. The ribbon is composed of a broad band of blue with a narrow white stripe separating it from narrow stripes of red, white and blue on either edge.

The Civil War Campaign Badge (No. 3); issued to officers and men for service in the United States Army in the Civil War. The ribbon is composed of two bands of red, white and blue; the red on the outside and the blue stripes separated by a narrow stripe of red. (No. 10), issued to those of the Navy and Marine Corps who served during the Civil War. The ribbon is blue and gray.

The Indian Wars Campaign Badge (No. 7); issued to those who served in the Army in the campaigns against the Indians. The ribbon is bright red with a darker stripe of red on either edge.

The Spanish-American War Campaign Badge (No. 6); issued to those who served in the Army in the Spanish War, in Cuba, Porto Rico or the Philippines. The ribbon is composed of a broad band of yellow, between two bands of red, with a narrow border of blue on either edge. (No. 12), issued to officers and men of the Navy and Marine Corps who served in Cuban, Porto Rican or Philippine Waters during the Spanish War. The ribbon is yellow with two stripes of red.

The Philippine Insurrection Campaign Badge (No. 19); issued for duty with the Army in the Philippines and for service with the several expeditions against the natives. The ribbon is composed of a broad blue band between two bands of red with a narrow stripe of blue on either edge.

The China Relief Expedition Badge (No. 25); issued for service ashore in China with the Peking Relief Expedition. The ribbon is a broad band of yellow edged with blue. (No.21), issued to those who served in the Navy and Marine Corps in Chinese Waters or ashore during the Boxer Uprising. The ribbon is yellow with a narrow black band near each edge.

The Dewey Congressional Medal (No. 1); issued to members of the Navy or Marine Corps who served with the Asiatic Squadron at Manila. The ribbon is composed of a yellow band with a blue band on either side.

The West Indies Campaign Medal (No. 4); issued for service during the West Indies Campaign in the Navy and Marine Corps. The ribbon is composed of three bands, the central one blue and the outside ones red. (No. 8), issued for specially meritorious service during the West Indies Campaign other than in battle, to officers and men of the Navy and Marine Corps. The ribbon is red.

The Philippine Campaign Badge (No. 24); issued to members of the Navy and Marine Corps who served in that campaign. The ribbon is red with a yellow band in the center.

The Cuban Pacification Badge (No. 22); issued to officers of the Navy and Marine Hospital Corps who served in Cuba. The ribbon is similar to that of the Army for this campaign (No. 20); olive drab, with red white and blue borders.

PASSPORTS.

Passports are required for entrance into Russia, Turkey and the Balkan countries, and must be visaed by diplomatic or consular representatives of those countries. There are no such representatives of the Balkan States in the United States and passports for those countries should be visaed by their diplomatic or consular representatives elsewhere. Passports may be required in other countries of persons making a prolonged stay, especially if they reside in boarding houses or rented apartments, but they are often valuable in the securing of registered mail, admissions to certain galleries, etc., which are normally closed to the public. Passports are issued by the Secretary of State. An American abroad may make his application before an American diplomatic or consular officer, who will forward it to the department. The fee for a passport is $1.00. This amount in currency or postal order should accompany each application made by a citizen of the United States. The orders should be made payable to the Disbursing Clerk of the Department of State. Drafts or checks are not accepted. A person who is entitled to receive a passport, if in the United States at the time, must make a written application in affidavit form to the Secretary of State. Application must be made by the person to whom the passport is to be issued, and signed by him, as one person cannot apply for a passport for another. The affidavit must be attested by an officer authorized to administer oaths, and an official seal must be affixed, or his official character must be authenticated by a certificate of the proper legal officer. The applicant must take the oath of allegiance to the Government of the United States. The oath is on the application blank. The application must be accompanied by a description of the applicant. Full data for these questions are provided on the blank. There are a number of different forms. There is one for a native citizen, one for the naturalized citizen, and one for a person claiming citizenship through the naturalization of husband or parent. In asking for a blank it should be specified which form is desired. A woman's application must state whether she is married or not, and a married woman must state whether her husband is a native or a naturalized citizen. A passport expires two years from the date of issue, but it may be extended for two years by a diplomatic or consular officer of the United States, if presented when it is about to expire. Applications for passports from naturalized citizens must be accompanied by a certificate of naturalization.

When the applicant is accompanied by his wife, minor children and a servant, to be entitled to receive the passport it is sufficient to state the fact, giving the respective ages of the children and the allegiance of the servant, then one passport will suffice for all. For any other person in the party a separate passport will be required. The woman's passport may include her minor children and servant under the above-named conditions. It should be noted, however, that the term "servant" does not include a governess, tutor, pupil, companion or person holding like relations to the applicant for passport. Professional or other titles will not be inserted in the passports. This information is obtained from the circular entitled, "Rules Governing the Granting and Issuing of Passports in the United States." which will be sent with the blank on application. It takes only a few days to obtain a passport. The intervention of those who make a business of securing passports is entirely unnecessary. The blank is very simple and only requires the filling out of the important details, such as the description of the applicant, the taking of the oath of allegiance before a notary public or other officer who is entitled to take similar oaths, and the application must be signed by a credible witness. Some concerns make a business of obtaining passports at a fee of from $2.00 to $5.00, but with the instructions given in this book and the rules given in the circular sent, their services are entirely unnecessary. Information revised by officials of the Department of State on May 13, 1912.

WORDING OF PASSPORT.

Good only for two years from date.

(Coat of Arms).

UNITED STATES OF AMERICA.

Department of State.

To all to whom these presents shall come, Greeting: I, the undersigned, Secretary of State of the United States of America, hereby request all whom it may concern to permit .....

a Citizen of the United States ——————

..... Safely..

and freely to pass and in case of need to give .....all lawful Aid and Protection.

(SEAL of the Department of State.)

Given under my hand and the Seal of the Department of State, at the City of Washington, the .....day of .....in the year 1910, and of the Independence of the United States the one hundred and thirty-fourth.

(Signature of the Secretary of State.)

Description,

Age.....Years.....
Stature.....Feet..... Inches Eng.
Forehead.....
Eyes.....
Nose.....
Mouth.....
Chin.....
Hair.....
Complexion.....
Face.....

Signature of the Bearer.

.....

No.....

Note.—The Department of State has refused to grant permission to reproduce a real Passport, hence this rather insufficient substitute.

THE NOBEL PRIZES.

The Nobel Foundation is based upon the last will and testament of Dr. Alfred Bernhard Nobel, engineer and inventor of dynamite, dated December 27, 1895, the stipulations of which, respecting this fund, are as follows:

"The rest of my fortune, that is, the capital realized by my executors, is to constitute a fund, the interest of which is to be distributed annually as a prize to those who have in the course of the previous year rendered the greatest services to humanity. The amount is to be divided into five equal parts, one of which is to be awarded to the person who has made the most important discovery in the domain of physical science; another to the one who has made the most valuable discovery in chemistry or brought about the greatest improvement; the third to the author of the most important discovery in the field of physiology or medicine; the fourth to the one who has produced the most remarkable literary work of an idealistic tendency, and finally the fifth to the person who has done the best or the most in the cause of the fraternity of nations, for the suppression or the reduction of standing armies as well as for the formation and propagation of peace congresses. The prizes will be awarded for physics and chemistry by the Swedish Academy of Sciences; for works in physiology and medicine by the Caroline Institute of Stockholm; for literature by the Stockholm Academy, and finally for the service in the cause of peace by a committee of five members of the Norwegian Storthing. It is my express desire that the benefits of the foundation are to be open to all nationalities and sexes and that the prize be awarded to the one most worthy, whether Scandinavian or not."

Each prize amounts to about $40,000, and the corporation designates a "Comité Nobel" composed of three or five members for each section, with headquarters at Christiana, Norway.

As expressed in the will no consideration is paid to the nationality of the candidate, but it is essential that every candidate shall be proposed in writing by some qualified representative of science, literature, etc., in the chief countries of the civilized world, such proposals to reach the Committee before the first of February in each year, the awards being made on the following 10th of December, the anniversary of Mr. Nobel's death.

The first distribution of prizes took place in 1901 and including the awards of 1911 only two prizes have been awarded to Americans; 1906, Prof. A. A. Michelson, Physics; 1906, Theodore Roosevelt, Peace. The following awards were made in 1911: Physics, Prof. William Wein, German; Chemistry, Mme. Marie S. Curie, French; Medicine, Allvar Gullstrand, Swede; Literature, Maurice Maeterlinck, Belgian; Peace, Prof. T. C. M. Asser, Dutch, and Alfred Fried, Austrian.

THE HALL OF FAME.

"The Hall of Fame for Great Americans" is the name of an open colonnade attached to the Library of the University of the City of New York, on University Heights in New York city, Borough of the Bronx, in which are inscribed on bronze tablets the names of famous American men and women. Nominations for the honor are made by the public and are submitted to a committee of 100 eminent citizens. In the case of men fifty-one votes are required and in the case of women forty-seven. The first balloting took place in October, 1900, when the following were chosen:

George Washington.
Abraham Lincoln.
Daniel Webster.
Benjamin Franklin.
Ulysses S. Grant.
John Marshall.
Thomas Jefferson.
Ralph W. Emerson.
H. W. Longfellow.
Robert Fulton.
Horace Mann.
Henry W. Beecher.
James Kent.
Joseph Story.
John Adams.
Washington Irving.
Jonathan Edwards.
Samuel F. B. Morse.
David G. Farragut.
Henry Clay.
Nathaniel Hawthorne.
George Peabody.
Robert E. Lee.
Peter Cooper.
Eli Whitney.
John J. Audubon.
William E. Channing.
Gilbert Stuart.
Asa Gray.

Chosen in 1905.

John Quincy Adams.
James Russell Lowell.
William T. Sherman.
James Madison.
John G. Whittier.
Alexander Hamilton.
Louis Agassiz.
John Paul Jones.
Mary Lyon.
Emma Willard.
Maria Mitchell.

Chosen in 1910.

Harriet Beecher Stowe.
Oliver Wendell Holmes.
Edgar Allan Poe.
Roger Williams.
James Fenimore Cooper.
Phillips Brooks.
William Cullen Bryant.
Frances E. Willard.
Andrew Jackson.
George Bancroft.
John Lothrop Motley.

SALARIES OF OFFICIALS OF THE FEDERAL GOVERNMENT.

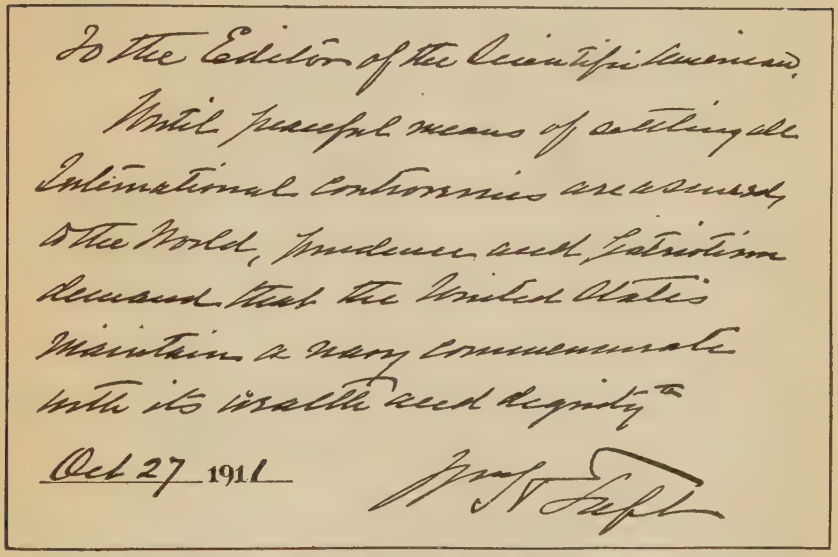
The Executive: President, $75,000; Vice-President, $12,000; Cabinet Officers, $12,000; Assistant Secretaries, $5,000, except Assistant Secretary of Navy, $4,500. Treasury Department: Treasurer of United States, $8,000; Comptroller of Treasury, $6,000; Commissioner of Internal Revenue, $6,000; War Department: Chief of Staff, $8,000; Adjutant General, $8,000; Inspector, Judge Advocate, Quartermaster, Commissary, Surgeon and Paymaster-Generals, $6,000; Navy Department: President General Navy Board, $13,500; President Naval Retiring Board, $8,000; Post-Office Department: Assistant Postmaster Generals, $5,000; Interior Department: Commissioner of Education, Land Office, Pensions, Indian Affairs and Patents, $5,000; Department of Justice: Assistant Attorney Generals, $5,000. Department Agriculture: Chief, Weather Bureau, $6,000; Chief Forest Service, $5,000; Department of Commerce and Labor: Commissioner Corporations, Labor, Light-House Bureau and General Immigration, $5,000; Director of Census, $7,000; Commissioner Fisheries, $6,000. The members of the Interstate Commerce Commission receive $10,000.

The Legislative: Senators and Representatives in Congress receive $7,500.

The Judiciary: The Chief Justice of the United States receives $15,000; Associate Justices, $14,500.

CHAPTER XV.

NAVIES OF THE WORLD.


To the Editor of the Scientific American.

With peaceful means of settling all International controversies as advocated by the World, Prudence and Patriotism demand that the United States Maintain a Navy commensurate with its wealth and dignity.

Oct 27 1911

LETTER FROM PRESIDENT TAFT, COMMANDER-IN-CHIEF OF THE UNITED STATES NAVY.

THE NEW "EYES" OF THE MAN BEHIND THE MAN BEHIND THE GUN.

Aeronautics has developed in such a remarkable manner in the last few years that it is impossible to surmise when or where progress will be arrested. At the present time the aeroplane can be used to extend the range of vision of the fleet, but when operating beyond the sight of its base, parent ship, or landmarks, it is hampered for scouting purposes by lack of navigational facilities for the determination of course and position. It is very probable that these will come, and with them also come a vast increase in the value of the aeroplane as a naval scout. As a station from which to observe and correct the fall of shot the aeroplane will be of service, particularly where long range, indirect, high-angle firing is used as in case of a bombardment. Here, however, the question of communication is seriously involved, as much depends on the prompt and accurate transmission of information. Steady progress is being made in the development of wireless which gives promise of meeting all the requirements of the situation, and which will insure the efficiency of the aeroplane for the purposes of spotting, as above outlined. The hydræroplane, which is an American development, and which may be launched from a vessel, and alight in the water alongside on the return from a trip aloft, further increases the possibility of the aeroplane as a naval adjunct.—Thomas T. Craven, Lieutenant Commander, U. S. N. Director of Target Practice and Engineering Competitions. (Page 414.)

SEA STRENGTH.

SHIPS.

TABLE I.—VESSELS BUILT.

	Battle-ships. Dread-nought type (a)	Battle-ships. (b)	Battle-Cruisers (c)	Ar-mor-ed Cr's.	Cruis-ers. (d)	Destroy-ers.	Torpedo Boats.	Subma-rines.	Coast Defense Vessels (e)
England	14	41	5	34	(k)72	(k)151	49	68	0
Germany	8	21	3	9	36	112	9	15	5
United States	7	25	0	11	18	39	20	20	4
France	0	20	0	22	10	72	157	66	2
Japan	1	13	0	13	12	56	38	12	2
Russia	0	9	0	6	9	94	14	31	2
Italy	0	8	0	9	4	23	36	8	0
Austria	0	6	0	3	4	12	37	6	6

TABLE II.—VESSELS BUILDING OR AUTHORIZED.

	Battle-ships. Dread-nought type.	Battle-ships.	Armor-ed Cruis'rs. Invinci-ble type.	Armor-ed Cruisers	Cruis-ers.	Destroy-ers.	Tor-pedo Boats	Subma-rines.
England(f)	11	0	(k)6	0	(k)19	(k)50	0	(k)22
Germany(g)	9	0	3	0	7	20	0	(i)17
United States	5	0	0	0	1	11	0	19
France	7	0	0	0	0	12	0	23
Japan(h)	2	0	4	0	3	2	0	5
Russia	7	0	4	0	0	13	0	8
Italy	8	0	0	0	3	18	39	11
Austria	4	0	0	0	3	6	12	6

(a) Battleships having a main battery of all big guns (11 inches or more in caliber).

(b) Battleships, 1st class, are those of (about) 10,000 tons or more displacement.

(c) Armored cruisers having guns of largest caliber in main battery and capable of taking their place in line of battle with the battleships. They have an increase of speed at the expense of carrying fewer guns in main battery, and a decrease in armor protection; now called battle cruisers.

(d) Includes all unarmored cruising vessels above 1,500 tons displacement.

(e) Includes smaller battleships and monitors. No more vessels of this class are being proposed or built by the great powers.

(f) England has no continuing shipbuilding policy, but usually lays down each year 5 armored ships with a proportional number of smaller vessels.

(g) Germany has a continuing shipbuilding program, governed by a fleet law authorized by the Reichstag. For 1912 there are authorized 1 battleship, 1 armored cruiser, 2 cruisers, 12 destroyers. Eventual strength to consist of 41 battleships, 20 armored cruisers, 40 cruisers, 144 destroyers.

(h) $78,837,591 authorized to be expended from 1911 to 1917 for the construction of war vessels.

(i) $3,570,000 authorized for experiments and further construction.

(k) Includes vessels of colonies.

NOTE:—Vessels undergoing trials are considered as completed.

The following vessels are *not* included in the tables:

Those over twenty years old unless they have been reconstructed and rearmed within 5 years; torpedo craft over 15 years old.

Transports, colliers, repair ships, converted merchant vessels, or any other auxiliaries.

Vessels of less than 1,500 tons, except torpedo craft. Torpedo craft of less than 50 tons.

Table II includes vessels authorized but not yet laid down, as well as those actually under construction.

UNITED STATES NAVAL ENLISTMENT

The term of enlistment of all enlisted men in the Navy is four years, except for minors under eighteen, who enlist with the consent of parents or guardian. Minors over the age of eighteen may be enlisted without the consent of parents or guardian, but must furnish written statement as to their age. Every person must pass the physical examination prescribed in the medical instructions. Only American citizens of good character who may reasonably be expected to remain in the service are enlisted, and every applicant must be able to read and write English and must take the oath of allegiance. No person under the age of seventeen can be enlisted.

PERSONNEL.

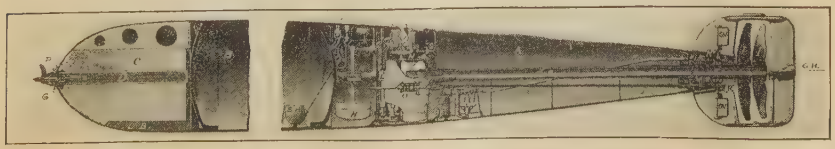
TABLE III.

RANK.	England.	France.	Germany.	Japan.	United States.
Admirals of the fleet	3	.....	2	1	*1
Admirals	12	.....	4	7	.....
Vice admirals	22	15	13	17	.....
Rear admirals	55	30	21	45	(f)27
Captains and commanders	634	340	321	292	211
Other line officers	2,320	1,547	1,708	1,818	1,522
Midshipmen at sea	540	60	398	154	.....
Engineer officers	912	505	487	683	.....
Medical officers	593	(b)413	304	(e)368	312
Pay officers	685	216	242	341	200
Chaplains	139	.....	.....	.....	23
Warrant officers	2,528	(c)2,387	2,644	1,520	683
Enlisted men	106,704	54,734	54,338	42,043	47,847
Marine officers	420	.....	109	.....	319
Enlisted men (marines)	(a)19,880	.....	(d)6,070	.....	9,506
Total	135,027	60,247	66,542	47,289	60,651

* The Admiral of the Navy.
(a) Includes 3,100 men of the Coast Guard.
(b) Includes pharmacists and apothecaries.
(c) Includes adjutants, premier maîtres, and maîtres of all branches.
(d) Marine infantry and seaman artillery.
(e) Includes pharmaceutical officers.
(f) The United States now has, temporarily, as extra numbers, due to promotion for war service, and to officers restricted by law to engineering duty only on shore, 9 flag officers, 25 captains, 4 commanders, 10 lieutenant commanders, and 1 lieutenant.

RELATIVE ORDER OF WAR SHIP TONNAGE.

PRESENT ORDER (TONNAGE COMPLETED).		AS WOULD BE THE CASE WERE VESSELS BUILDING NOW COMPLETED.	
Nation.	Tonnage.	Nation.	Tonnage.
Great Britain	1,888,414	Great Britain	2,469,678
Germany	787,799	Germany	1,146,238
United States	758,499	United States	914,744
France	619,512	France	804,211
Japan	438,067	Japan	617,083
Russia	294,580	Russia	469,380
Italy	196,227	Italy	353,961
Austria	158,420	Austria	260,719



A PRESENT DAY MODIFIED WHITEHEAD TORPEDO. (Page 424.)

THE IMPORTANCE OF THE COMMAND OF THE SEA.

By Alfred T. Mahan

Rear Admiral, U. S. N. (Retired).

The existing contest between Italy and Turkey, confined as it is to the sea and to the possession of Tripoli, has a double interest. It illustrates on the one hand the gradual, yet perpetual, process by which a higher civilization impinges upon a lower; that is, upon one that is lower in virile efficiency, however in some instances it may have been higher in acquired material comfort, or even in literary and artistic achievement. This tendency can neither be regulated by law, nor brought to the bar of law, without injury to the progress of the world toward better universal conditions, to which end it is essential that the efficient supplant the inefficient. On the other hand this collision illustrates the importance of the command of the sea. This also, it should be noted, has been incidental and determinative in the progress of the world. Through having this command, Italy thus far has been able to localize the land fighting in Tripoli, and probably can continue to do so; to the great relief of her own resources, and that of a watching and anxious Europe.

It is to this second consideration that I am here limited by my subject—"The Importance of the Command of the Sea"—with a somewhat special reference to that importance as touching the United States. The United States in her turn, after having achieved national efficiency, by the quenching of internal discord in a bitter and bloody contest, has found herself compelled inevitably into the same path of seeming aggression upon less efficient social and political communities; to bear her part of "the white man's burden," as it has been styled. For in essence this process is not one of aggrandizement, but of responsibility; responsibility not to law, which always lags behind conditions, but to moral obligation entailed by the particular circumstances of the moment of action.

This moral side of the question is not irrelevant to the military one of the importance of commanding the sea; for granting the end—the moral obligation—the means, if not themselves immoral, follow as a matter of course. Of such means, command of the sea is one. Napoleon said that *morale* dominates war; and it is correspondingly true that a sense of right powerfully reinforces the stability of national attitude and the steadfastness of national purpose. If we have been right, morally, step by step, in the forward march of the past few years, we are morally bound to sustain the position attained, by measures which will provide the necessary means. Of these an adequate navy is among the first; probably, in our case, the chief of all.

Here, as always, it is necessary to recur to experience—to the past—in order to comprehend the present and to project the future. Why do English innate political conceptions of popular representative government, of the balance of law and liberty, prevail in North America from the Arctic Circle to the Gulf of Mexico, from the Atlantic to the Pacific? Because the command of the sea at the decisive era belonged to Great Britain. In India and Egypt, administrative efficiency has taken the place of a welter of tyranny, feudal struggle, and bloodshed, achieving thereby the comparative welfare of the once harried populations. What underlies this administrative efficiency? The British navy, assuring in the first instance British control instead of French and thereafter communication with the home country, whence the local power without which administration everywhere is futile. What, at the moment the Monroe Doctrine was proclaimed, insured beyond peradventure the immunity from foreign oppression of the Spanish-American colonies in their struggle for independence? The command of the sea by Great Britain, backed by the feeble navy but imposing strategic situation of the United States, with her swarm of potential commerce-destroyers, which a decade

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before had harassed the trade of even the mistress of the seas.

Less conspicuously, but no less truly, to what do Algiers and Tunis, and to what eventually will Morocco, owe redemption from conditions barely, if at all, above the barbarous? To the command of the sea by the nation which already has restored the former two, to be fruitful members of the world community. That South Africa is now a united commonwealth, instead of two opposing communities, such as the North and South of our own country might have been, is due to the same cause; a local preponderance of force insured by sea power. It may safely be claimed that to the navy of the United States chiefly is owing the present Union, instead of the existence of two rival nations vying, or trying to vie, with each other in military preparations, like the nations of Europe. The four years' struggle of the Confederate States might not have ended in exhaustion, had it not been for the blockade, which shut in their cotton and shut out their supplies.

Contrast this impressive exhibit, where the command of the sea has been operative, with the history and achievement of those great States which have not possessed it. Contrast Bosnia and Herzegovina for Austria, Alsace and Lorraine for Germany, with the expansion of France, Great Britain, Holland, and with that which Spain once possessed; now lost through an inefficiency, one of the first symptoms of which was the decay of her navy. The magnificent efficiency of the present German Empire strives now, against almost hopeless disadvantage, for the opportunity to exercise that efficiency outside its European limits. Opportunity was lost through the absence of naval force in the past centuries, when the maritime countries were occupying, and, in accordance with their respective political aptitudes, were determining the future of immense tracts of the world. Much time must elapse before we shall know the inside history of the still unarranged dispute with France about Morocco; but there is reason to believe that the consciousness of the British navy at the back of France has been one of the large factors in the negotiations. At least it is apparent that bitterness against Great Britain has been even more marked than against France.

The lesson for the United States is plain. In the strategic position before mentioned, in remoteness from Europe, in the rivalries of European nations, we still have a local and international advantage for preponderance in American waters; but it is not so great as to confer certainty without reasonable provision for insuring command of the sea. In the Pacific, which is equally our coast line, and to which the future mostly looks, we have no similar advantage. Much as I dislike and reject the phrase "supremacy in the Pacific," it is true that we there have duties which in case of disputes will require the presence of naval force adequate to command. Duty to the mutual support of our two chief coasts dictates full control of the Panama Canal, which from the military standpoint is the key to any broadly planned system of preparation for national defense.

But obligation is no less on account of the Philippine Islands. Having assumed control of these under imperative circumstances, we are bound in honor to support an undertaking, our fitness for which is attested by results. To them we are responsible for the maintenance of conditions under which material prosperity can advance, and their dissimilar and discordant inhabitants reach a homogeneous civilization and political development which will enable them to govern themselves. To Cuba, though independent, we owe by specific guarantees of maintenance of a like internal security. These national and international functions can be discharged, certainly only by command of the sea. The Pacific, the Atlantic, and the Caribbean, with the great controlling stations, Porto Rico, Guantanamo, the Canal Zone, and Hawaii, depend upon this command, the exponent of which is the navy, and in which ships and stations are interdependent factors. To place the conclusion concretely and succinctly, the question of command of the sea is one of annual increase of the navy. This question is not "naval," in the restricted sense of the word. It is one of national policy, national security, and national obligation.

Courtesy of the "Aero Club of America Bulletin." From a painting by Henry Reuterdahl

THE NEW "EYES" OF THE MAN BEHIND THE MAN BEHIND THE GUN. (Page 409.)

SHIPS' DATA, U. S. NAVAL VESSELS.

Type.	Fit for service, including those under repair.		Under construction.		Authorized.		Unfit for sea service.		Total.	
	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.
		Tons.		*Tons.*		*Tons*		*Tons.*		*Tons.*
First-class battleships	29	406,146	6	149,650	2	55,000	.....	.....	37	610,796
Armored cruisers	10	140,080	.....	.....	.....	.....	.....	.....	10	140,080
First-class cruisers	5	46,465	.....	.....	.....	.....	.....	.....	5	46,465
Single-turret monitors	4	12,900	.....	.....	.....	.....	.....	.....	4	12,900
Double-turret monitors	6	26,104	.....	.....	.....	.....	.....	.....	6	26,104
Protected cruisers	17	67,574	.....	.....	.....	.....	.....	.....	17	67,574
Unprotected cruisers	2	4,144	.....	.....	.....	.....	.....	.....	2	4,144
Scout cruisers	3	11,250	.....	.....	.....	.....	.....	.....	3	11,250
Gunboats	7	8,677	.....	.....	1	(1)	.....	.....	8	[2] 8,677
Gunboat for Great Lakes	.....	.....	.....	.....	1	(1)	.....	.....	1	(1)
Light-draft gunboats	3	4,155	.....	.....	1	(1)	.....	.....	4	[2] 4,155
Composite gunboats	8	8,190	.....	.....	.....	.....	.....	.....	8	8,190
Training ships, steel	2	3,600	.....	.....	.....	.....	.....	.....	2	3,600
Training brigantine	1	346	.....	.....	.....	.....	.....	.....	1	346
Special class	2	2,416	.....	.....	.....	.....	.....	.....	2	2,416
Gunboats under 500 tons	9	2,439	.....	.....	.....	.....	.....	.....	9	2,439
Torpedo-boat destroyers	33	19,099	9	6,678	8	8,271	.....	.....	50	34,048
Steel torpedo boats	31	5,111	.....	.....	.....	.....	.....	.....	31	5,111
Submarine torpedo boats	18	3,748	17	7,732	4	(3)	.....	.....	39	[4] 11,480
Iron steam vessels	3	3,056	.....	.....	.....	.....	.....	.....	3	3,056
Wooden steam vessels	3	5,565	.....	.....	.....	.....	3	4,140	6	9,705
Wooden sailing vessels	4	5,620	.....	.....	.....	.....	2	6,350	6	11,970
Tugs	44	[5] 15,713	.....	.....	2	2,240	.....	.....	46	[5] 17,953
Auxiliary cruisers	4	24,959	.....	.....	.....	.....	.....	.....	4	24,959
Converted yachts	18	10,106	.....	.....	.....	.....	.....	.....	18	10,106
Colliers	20	[6] 150,462	2	38,735	4	76,264	.....	.....	26	[6] 265,461
Submarine tenders	5	6,771	.....	.....	1	(1)	.....	.....	6	[2] 6,771
Mine-laying ship	1	4,083	.....	.....	.....	.....	.....	.....	1	4,083
Repair ship	1	3,380	.....	.....	.....	.....	.....	.....	1	3,380
Transports and supply ships	8	44,384	.....	.....	.....	.....	.....	.....	8	44,384
Hospital ships	2	9,000	.....	.....	.....	.....	.....	.....	2	9,000
Receiving ships	5	23,408	.....	.....	.....	.....	5	18,790	10	42,198
Prison ships	3	[7] 4,005	.....	.....	.....	.....	1	1,100	4	[7] 5,105
Total	312	1,082,956	34	202,795	24	141,775	11	30,380	382	1,457,906

[1] Not designed.
[2] Excepting the 1 authorized.
[3] Contracts not signed.
[4] Excepting the 4 authorized.
[5] Excepting Locust.
[6] Excepting Justin.
[7] Excepting Southery.

Note.—The second-class battleship San Marcos was stricken from the Navy List Oct. 11, 1911.

Correct to July, 1911.

SHIPS' DATA, U. S. NAVAL VESSELS.

Type.	Fit for service, including those under repair.											
	1906		1907		1908		1909		1910		1911	
	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.
		Tons.		*Tons.*		*Tons.*		*Tons.*		*Tons.*		*Tons.*
First-class battleships	16	198,250	22	292,146	25	334,146	25	334,146	29	406,146	29	406,146
Second-class battleship	1	6,315	1	6,315	1	6,315	1	6,315	1	6,315	....	.....
Armored cruisers	4	54,720	6	83,720	9	125,580	10	140,080	10	140,080	10	140,080
First-class cruisers	3	27,065	5	46,465	5	46,465	5	46,465	5	46,465	5	46,465
Armored ram	1	2,183	1	2,183	1	2,183	1	2,183	....	.....	....	.....
Single-turret monitors	4	12,900	4	12,900	4	12,900	4	12,900	4	12,900	4	12,900
Double-turret monitors	6	26,104	6	26,104	6	26,104	6	26,104	6	26,104	6	26,104
Protected cruisers	19	76,070	19	76,070	19	76,070	18	71,987	18	71,987	17	67,574
Unprotected cruisers	3	6,216	3	6,216	3	6,216	3	6,216	3	6,216	2	4,144
Scout cruisers	....	.....	....	.....	2	7,500	3	11,250	3	11,250	3	11,250
Gunboats	9	11,564	9	11,564	9	11,564	9	11,564	8	10,387	7	8,677
Light-draft gunboats	3	4,155	3	4,155	3	4,155	3	4,155	3	4,155	3	4,155
Composite gunboats	8	8,190	8	8,190	8	8,190	8	8,190	8	8,190	8	8,190
Training ship, sheathed	1	1,175	1	1,175	1	1,175	1	1,175	....	.....	....	.....
Training ships, steel	....	.....	2	3,600	2	3,600	2	3,600	2	3,600	2	3,600
Training brigantine	1	346	1	346	1	346	1	346	1	346	1	346
Special class	2	2,416	2	2,416	2	2,416	2	2,416	2	2,416	2	2,416
Gunboats under 500 tons	15	3,603	13	3,265	12	3,095	12	3,095	12	3,095	9	2,439
Torpedo-boat destroyers	16	6,695	16	6,695	16	6,695	16	6,695	21	10,195	33	19,099
Steel torpedo boats	35	5,737	35	5,737	35	5,737	33	5,299	33	5,299	31	5,111
Wooden torpedo boats	1	31	1	31	1	31	1	31	1	31	....	.....
Submarine torpedo boats	8	935	8	935	12	1,719	12	1,719	18	3,485	18	3,748
Iron steam vessels	5	5,861	4	3,606	3	3,056	3	3,056	3	3,056	3	3,056
Wooden steam vessels	5	8,840	5	8,840	5	8,840	5	8,840	3	5,565	3	5,565
Wooden sailing vessels	8	10,045	8	10,045	5	5,895	5	5,895	5	5,895	4	5,620
Tugs	41	13,060	40	12,703	41	13,606	42	14,361	43	[1] 15,013	44	[1] 15,713
Auxiliary cruisers	5	28,339	5	28,339	4	24,959	4	24,959	4	24,959	4	24,959
Converted yachts	23	11,881	23	11,872	22	11,750	21	11,453	19	10,421	18	10,106
Colliers	15	[2] 74,854	15	[2] 74,854	15	[2] 74,854	15	[2] 74,854	20	[2] 135,417	20	[2] 150,462
Submarine tenders	....	.....	1	357	2	807	2	807	4	4,702	5	6,771
Mine-laying ship	....	.....	....	.....	....	.....	1	4,083	1	4,083	1	4,083
Repair ship	....	.....	....	.....	1	3,380	1	3,380	1	3,380	1	3,380

[1] Excepting Locust.

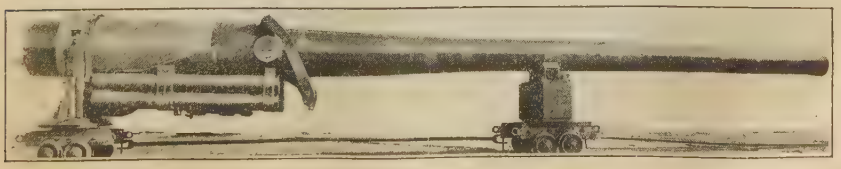
[2] Excepting Justin.

SHIPS' DATA, U. S. NAVAL VESSELS.

Type.	Fit for service, including those under repair.											
	1906		1907		1908		1909		1910		1911	
	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.
		Tons.		*Tons.*		*Tons.*		*Tons.*		*Tons.*		*Tons.*
Transports and supply ships	11	53,247	10	50,571	9	50,084	8	44,384	8	44,384	8	44,384
Hospital ships	1	3,300	1	3,300	1	3,300	2	9,000	2	9,000	2	9,000
Receiving ships	4	18,995	5	21,250	5	21,250	4	18,995	4	18,995	5	23,408
Prison ships	2	[1] 4,850	2	[1] 4,850	2	[1] 4,850	3	[1] 7,105	3	[2] 4,005	3	[2] 4,005
Total	276	87,942	285	830,815	292	918,833	292	937,103	308	1,067,537	312	1,082,956

Type.	Under construction.											
	1906		1907		1908		1909		1910		1911	
	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.	Number.	Displacement.
		Tons.		*Tons.*		*Tons.*		*Tons.*		*Tons.*		*Tons.*
First-class battleships	9	135,896	5	74,000	4	72,000	6	115,650	4	95,650	6	149,650
Armored cruisers	6	85,360	4	56,360	1	14,500	....	.....	....	.....	....	.....
First-class cruisers	2	19,400	....	.....	....	.....	....	.....	....	.....	....	.....
Scout cruisers	3	11,250	3	11,250	1	3,750	....	.....	....	.....	....	.....
Training ships, steel	2	3,600	....	.....	....	.....	....	.....	....	.....	....	.....
Torpedo-boat destroyers	....	.....	....	.....	5	3,500	20	14,630	15	11,130	9	6,678
Submarine torpedo boats	4	784	4	784	7	2,103	16	5,890	10	4,124	17	7,732
Tugs	....	.....	2	1,510	2	1,510	1	755	....	.....	....	.....
Colliers	....	.....	2	25,170	2	25,170	6	78,220	2	38,735	2	38,735
Total	26	256,290	20	169,074	22	122,533	49	215,145	31	149,639	34	202,795

[1] Includes Southery. [2] Excepting Southery.



NEW 14-INCH GUN USED FOR ARMOR ATTACK.

UNITED STATES NAVAL ORDNANCE

GUN.	MARK.	Length in Calibres.	Total Length.	Capacity of Chamber in Cubic Inches.	Travel of Projectile in Inches.	Weight of Gun.	Weight of Projectile.	Weight of Charge.	Muzzle Velocity.	Muzzle Energy.	Penetration at Muzzle, Krupp Armour, using Capped Projectile.	At 3000 Yards.		At 6000 Yards.		At 9000 Yards.	
												Remaining Velocity.	Penetration.	Remaining Velocity.	Penetration.	Remaining Velocity.	Penetration.
			inch.			tons.	lbs.	lbs.	ft.-seconds.	ft.-tons.	inch.	ft.-seconds.	inch.	ft.-seconds	inch.	ft.-seconds.	inch.
3-in. R.F.G.	II., III.	50	154	219	128·3	0·9	13	3·85	2700	658	3·3	1230	1·2	848	0·8	..	..
3-in. S.A.	V., VI.	50	159	219	128·3	1·0	13	3·85	2700	658	3·3	1230	1·2	848	0·8	..	..
4-in. R.F.G.	III., IV., V., VI.	40	164	331	134·5	1·5	33	4·85	2000	915	3·4	1156	1·7	897	1·2	..	..
4-in. R.F.G.	VII.	50	205	652	168·3	2·8	33	5·0	2500	1,430	4·6	1432	2·2	979	1·4	853	1·2
4-in. R.F.G.	VIII.	50	205	652	168·3	2·9	33	12·3	2800	1,794	5·3	1627	2·6	1033	1·5	878	1·2
5-in. R.F.G.	II., III., IV	40	206	656	167·8	3·1	50	10·0	2300	1,834	5·3	1286	2·6	934	1·7	829	1·4
5-in. B.L.R.	V., VI.	50	256	1,200	215·6	4·6	60	19·2	2700	3,032	6·2	1692	3·5	1102	2·0	928	1·6
5-in. B.L.R.	VI.	50	256	1,200	215·6	4·6	50[1]	20·5	3000[1]	3,122	6·4	1732	3·2	1057	1·7	877	1·4
5-in. R.F.G.	VII.	51	261	1,165	215·6	5·0	50	23·8	3150	3,439	6·8	1835	3·4	1091	1·8	895	1·4
6-in. R.F.G.	II., III.	30	196	1,318	145·4	4·8	105	18·8	1950	2,768	5·3	1305	3·2	1009	2·3	909	2·0
6-in. R.F.G.	IV., VII	40	256	1,320	205·8	6·0	105	18·8	2150	3,365	6·0	1440	3·6	1058	2·4	934	2·1
6-in. R.F.G.	IX.	45	270	1,320	221·7	7·0	105	18·8	2250	3,685	6·3	1511	3·8	1086	2·5	948	2·1
6-in. B.L.R.	VI.	50	300	2,101	247·5	8·3	105	30·0	2600	4,920	7·6	1770	4·7	1207	2·9	996	2·2
6-in. B.L.R.	VIII.	50	300	2,101	247·5	8·6	105	37·0	2800	5,707	8·3	1923	5·2	1297	3·2	1026	2·3
7-in. B.L.R.	II.	45	323	3,643	259·8	12·7	165	58·0	2700	8,338	9·6	1948	6·4	1382	4·2	1083	3·0
8-in. B.L.R.	III., IV.	35	305	3,170	245·8	13·1	260	43·8	2100	7,948	8·6	1576	6·0	1206	4·2	1040	3·6
8-in. B.L.R.	V.	40	348	5,243	273·1	18·1	260	78·0	2500	11,264	10·6	1898	7·5	1428	5·3	1141	4·0
8-in. B.L.R.	VI	45	369	5,243	299·1	18·7	260	98·5	2750	13,360	12·0	2106	8·6	1589	6·1	1227	4·4
10-in. B.L.R.	I., II.	30	329	6,779	251·1	25·1	510	90·0	2000	14,141	10·7	1590	8·0	1274	6·1	1103	5·0
10-in. B.L.R.	III.	40	413	10,222	327·0	34·6	510	207·5	2700	25,772	15·6	2184	11·9	1717	9·0	1406	6·9
12-in. B.L.R.	I., II.	35	441	11,991	315·2	45·3	870	160·0	2100	26,596	14·2	1733	11·2	1433	8·8	1219	7·2
12-in. B.L.R.	III., IV.	40	493	17,096	392·2	52·1	870	237·5	2400	34,738	16·8	1994	13·3	1649	10·5	1376	8·3
12-in. B.L.R.	III., IV.	40	493	17,096	392·2	52·1	870	305·0[2]	2600[2]	40,768	18·5	2171	14·8	1801	11·7	1500	9·3
12-in. B.L.R.	V.	45	553	16,974	452·0	52·9	870	305·0	2700	43,964	19·4	2259	15·5	1877	12·3	1561	9·8
12-in. B.L.R.	VI.	45	553	14,970	452·0	53·6	870	340·0[3]	2850[3]	48,984	20·8	2393	16·6	1991	13·3	1653	10·6
12-in. B.L.R.	VII.	50	607	14,296	506·3	56·1	870	340·0[3]	2950[3]	52,483	21·7	2483	17·5	2071	13·9	1719	11·0
13-in. B.L.R.	I., II.	35	479	15,068	374·9	61·4	1130	180·0	2000	31,333	15·0	1679	12·0	1414	9·7	1221	8·1
14-in. B.L.R.	II.	45	642	..	..	63·1	1400	365·0	2600	65,606	28·3*	..	23·4*	..	..	..	..

* Harveyized armour.

Corrected to February, 1910.

Courtesy of "Brassey's Naval Annual," 1911.

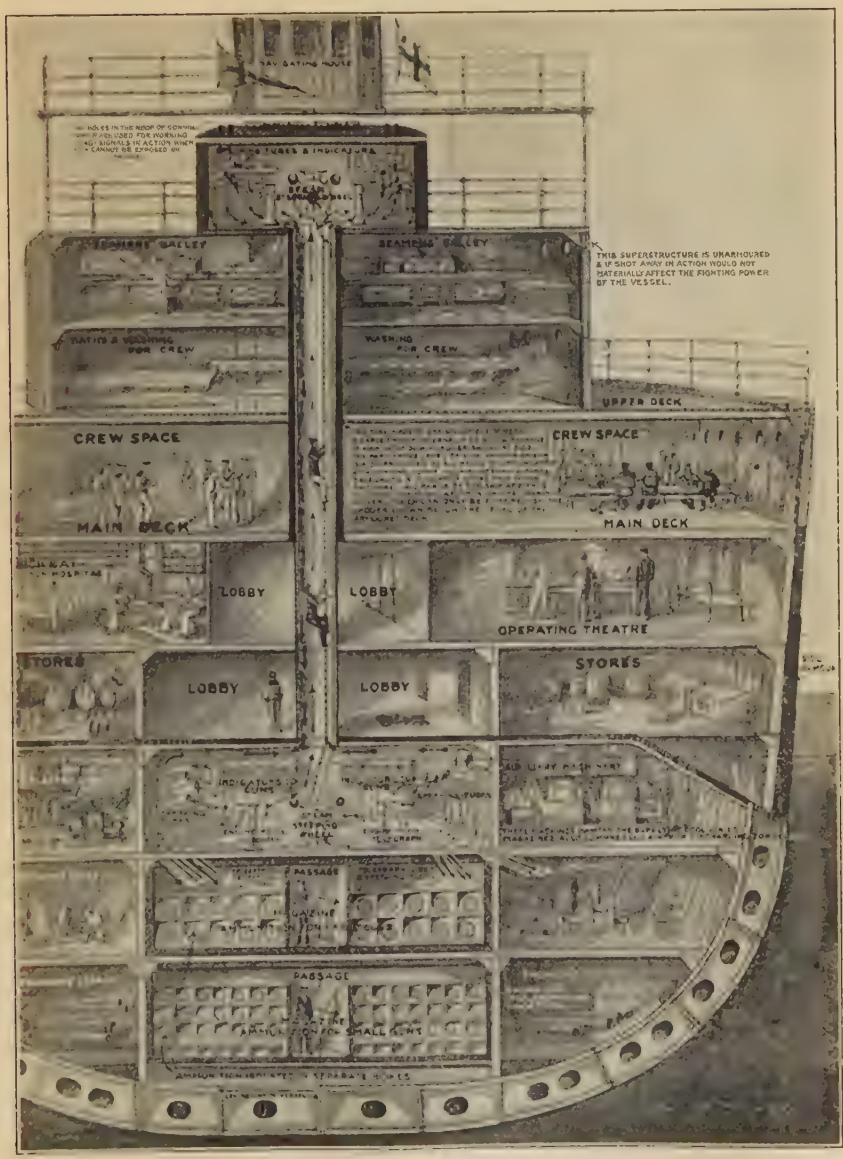
The following abbreviations are used in the tables of Armoured Ships, pages 420–424:

(ac) Armoured cruiser.
(b) Battleship.
(cds) Coast-defense ship.

ABBREVIATIONS.

(t) Turret-ship (In class column).
(t) Speed and I. H. P. at trials (In speed and I. H. P. column).
(H.S.) Harveyized or similar hard-faced steel.
(K S) Krupp steel.

(Sub.) Submerged torpedo tube.
(B. & W.) Babcock & Wilcox boilers.
(Nic.) Niclausse Boilers.
(W. T.) Water-tube Boilers.
(T.) Thornycoft boilers.



Courtesy of "The Illustrated London News."

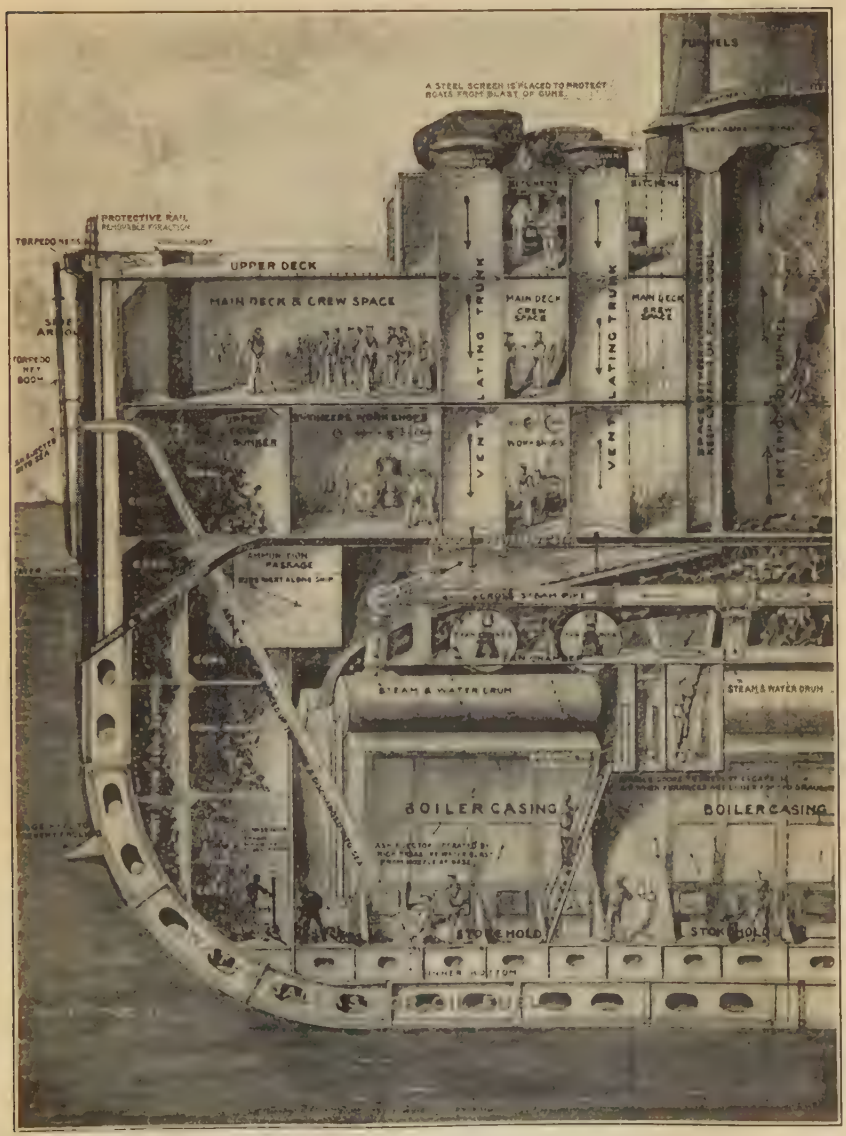
THE CONNING TOWER SECTION OF A "SUPER-DREADNOUGHT."

UNITED STATES—ARMOURED SHIPS.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Armour.						Armament.		Speed.	Coal.	Complement.
										Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
														Heavy Guns.	Secondary.					
		tons.	ft.	ft.	ft.					in.	in.	in.	in.	in.	in.			knots.	tons.	
t.	Alabama.	11,565	368	72¼	26	11,207 *t*	Philadelphia	1898	1900	16½–4 H.S.	2¾–4	5½ H.S.	12 H.S.	15 H.S.	6 H.S.	4 *13-in.*, 14 *6-in.*, 16 *6-pr.*, 2 *1-pr.*, 4 M., 2 l.	..	17·0 *t*	800 1270	592
b.	Arkansas	26,000	554	93¼	28½	28,000 tur.	Camden, N.J.	Bldg.	..	11–9 K.S.	..	..	8–6 K.S.	11 K.S	8	12 *12-in.*, 21 *5-in.*, 4 *3-pr.*, 2 M., 2 l.	2 (sub.)	20·5	1650 2500	1115
a. c.	Brooklyn.	9215	400½	62	26¼	18,425 *t*	Philadelphia	1895	1896	3 H.S.	6–3	4 H.S.	..	8 H.S.	5½ H.S.	8 *8-in.*, 12 *5-in.*, 12 *6-pr.*, 4 *1-pr.*, 4 M., 2 l.	..	22·2 *t*	900 1632	718
,,	California	13,680	502	69½	24½	29,381 *t* B. & W.	S. Francisco.	1904	1907	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 14 *6-in.*, 18 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	2 (sub.)	22·2 *t*	900 2000	829
,,	Charleston	9700	424	66	25½	27,200 B.&W.	Newport News	1904	1906	4 H.S.	3	4 H.S.	..	4 H.S.	..	14 *6-in.*, 18 *3-in.*, 12 *3-pr.*, 12 *1-pr.*, 10 M., 2 l.	..	22·0	650 1500	664
,,	Colorado.	13,680	502	69½	24½	26,837 Nic.	Philadelphia	1903	1905	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 14 *6-in.*, 18 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	2 (sub.)	22·2 *t*	900 2000	829
t.	Connecticut	16,000	450	76¾	26¾	20,525 B. & W.	Camden, N.J.	1904	1906	11½ K.S.	3	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *7-in.*, 20 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 (sub.)	18·8 *t*	900 2200	803
t.	Delaware	20,000	510	85½	27	29,025	Newport News	1909	1910	11 K.S.	..	10–8 K.S.	..	11 K.S.	5 K.S.	10 *12-in.*, 14 *5-in.*, 2 *3-pr.*, 2 l., 12 M.	2 (sub.)	21·5 *t*	1000 2500	927
t.	Florida	21,825	510	88½	27	28,000 tur.	New York	1910	..	11	..	10	..	11	5	10 *12-in.*, 16 *5-in.*, 4 *3-pr.*, 4 M., 2 l.	2 (sub.)	21·0	1000 2300	1014
Super-posed turrets.	Georgia	14,948	435	76¼	23¾ †	25,088 *t* Nic.	Bath, Me.	1904	1906	11–4 K.S.	3	6 K.S.	6 K.S.	11 K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 12 *6-in.*, 12 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 (sub.)	19·2 *t*	900 1704	812
b.	Idaho	13,000	375	77	25	14,235 B. & W.	Philadelphia	1905	1908	9–4 K.S.	3–1½	7 K.S.	7 K.S.	10–7½ K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 8 *7-in.*, 12 *3-in.*, 6 *3-pr.*, 4 *1-pr.*, 8 M., 2 l.	2 (sub.)	17·2 *t*	600 1750	725
t.	Illinois	11,565	368	72¼	26	12,757	Newport News	1898	1901	16½–4 H.S.	2¾–4	5½ H.S.	12 H.S.	15 H.S.	6 H.S.	4 *13-in.*, 14 *6-in.*, 16 *6-pr.*, 6 *1-pr.*, 4 M., 2 l.	..	17·45 *t*	800 1275	686
b.	Indiana	10,288	348	69¼	27¼	9,607 B. & W.	Philadelphia	1893	1895	18 H.S.	2¾	5 H.S.	17 H.S.	17 H.S.	10 H.S.	4 *13-in.*, 8 *8-in.*, 12 *3-in.*, 4 *6-pr.*, 2 M., 1 l.	..	15·5 *t*	400 1567	497

Courtesy of "Brassey's Naval Annual," 1912.

† Mean draught.



Courtesy of "The Illustrated London News."

THE BOILER-ROOM SECTION OF A "SUPER-DREADNOUGHT."

Note the Water-Tube Boilers.

UNITED STATES.—ARMOURED SHIPS.—Continued.

Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Armour.						Armament.		Speed.	Normal Coal Supply.	Complement.
										Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
														Heavy Guns.	Secondary.					
		tons.	ft.	ft.	ft.					in.	in.	in.	in.	in.	in.			knots.	tons.	
b	Iowa	11,340	360	72½	26¾	11,933	Philadelphia	1896	1897	14 H.S.	2¾	5 H.S.	12 H.S.	15 H.S.	8–6 H.S.	4 *12-in.*, 8 *8-in.*, 10 *4-in.*, 4 *6-pr.*, 6 M., 2 l.	..	17·1 *t*	625 1795	520
t.	Kansas	16,000	450	77	26¾	19,545 B. & W.	Camden, N.J.	1905	1907	8–11 K.S.	3–4½	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *7-in.*, 20 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 (sub)	18·1 *t*	900 2200	854
super-posed turrets	Kearsarge / Kentucky	11,540	368	72½	25¾	(11,788) (12,179)	Newport News	1898	1899	16½–4 H.S.	2¾–5	5½ H.S.	..	15 H.S.	9 H.S.	4 *13-in.*, 4 *8-in.*, 14 *5-in.*, 20 *6-pr.*, 8 *1-pr.*, 4 M., 2 l.	1 ..	16·8) 16·9) *t*	410 1591	(690 (686
t.	Louisiana	16,000	450	76¾	26¾	20,748 B. & W.	Newport News.	1904	1906	11–8 K.S.	3	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *7-in.*, 20 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 L.	4	18·8 *t*	900 2200	803
„	Maine	12,300	388	72½	25½	15,693 Nic.	Philadelphia	1901	1902	11–4 K.S.	2¾–4	6 K.S.	10 K.S.	12 K.S.	6 K.S.	4 *12-in.*, 16 *6-in.*, 6 *3-in.*, 8 *3-pr.*, 6 *1-pr.*, 2 M., 2 l.	2 sub.	18·0 *t*	1000 1800	551
a.c.	Manhattan	8200	380½	64½	27½	17,075	Philadelphia	1891	1893 1909	4 H.S.	2½	.. K.S.	..	6½ H.S.	5–4 H.S.	4 *8-in.*, 10 *5-in.*, 8 *12-pr.*, 4 *3-pr.*, 4 M.	..	21·0 *t*	750 1334	498
a.c	Maryland	13,680	502	69½	24½	28,059 B. & W.	Newport News.	1903	1905	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 14 *6-in.*, 18 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	2 sub.	22·4 *t*	900 1850	829
b.	Massachusetts	10,288	348	69¼	27⅓	10,240	Philadelphia	1893	1896	18 H.S.	2¾	5 H.S.	17 H.S.	17 H.S.	10–5 H.S.	4 *13-in.*, 8 *8-in.*, 12 *3-in.*, 4 *6-pr.*, 2 M., 2 l.	..	16·2 *t*	400 1560	509
„	Michigan	16,000	450	80½	24½	16,310 B. & W.	Camden, N.J.	1908	1909	11–9	3	8	10	10–8	8	8 *12-in.*, 22 *3-in.*, 2 *3-pr.*, 12 M., 2 l.	2 sub.	18·8 *t*	900 2200	669
a.c	Milwaukee	9700	424	66	25½	24,166 W.T.	S. Francisco.	1904	1906	4 H.N.S.	3	4 H.N.S.	..	4 H.N.S.	..	14 *6-in.*, 18 *14-pr.*, 12 *3-pr.*, 12 *1-pr.*, 10 M., 2 l.	2 sub.	22·2 *t*	650 1500	664
t.	Minnesota	16,000	450	77	26¾	20,235 B. & W.	Newport News	1905	1907	8–11 K.S.	3–4½	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *7-in.*, 20 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 sub.	18·8 *t*	900 2200	881
b.	Mississippi	13,000	375	77	24¾	13,607 B. & W.	Philadelphia	1905	1908	9–4 K.S.	3–1½	7 K.S.	7 K.S.	10–7½ K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 8 *7-in.*, 12 *3-in.*, 6 *3-pr.*, 4 *1-pr.*, 8 M., 2 l.	2 sub.	17·11 *t*	600 1750	725
t.	Missouri	12,300	388	72½	25½	15,845 T.	Newport News	1901	1903	12–4 K.S.	2¾–4	6 K.S.	10 K.S.	12 K.S.	6 K.S.	4 *12-in.*, 16 *6-in.*, 6 *3-in.*, 8 *3-pr.*, 4 *1-pr.*, 2 M., 2 l.	2 sub.	18·1 *t*	1000 1836	551
a.c.	Montana	14,500	502	72¾	25	27,938 B & W.	Newport News	1906	1908	5–3 K.S.	3	5 K.S.	6 K.S.	9 K.S.	5 K.S.	4 *10-in.*, 16 *6-in.*, 22 *3-in.*, 12 *3-pr.*, 4 *1-pr.*, 4 M., 2 l.	4 sub.	22·2 *t*	900 2000	845

c.d.s.,t.	**Monterey**	4084	256	59	15½	5244 B. & W.	S. Francisco.	1891	1893	13–6 H.S.	3	..	..	13 H.S.	..	2 *12-in.*, 2 *10-in.*, 6 *6-pr.*, 4 *1-pr.*, 2 M.	..	13·6 *t*	200 233	218
Superposed turrets.	**Nebraska**	14,948	435	76¼	23¾ †	21,283 B. & W.	Seattle.	1904	1907	11–4 K.S.	3	6 K.S.	6 K.S.	11 K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 12 *6-in.*, 12 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 sub.	19·1 *t*	900 1900	812
t.	**New Hampshire**	16,000	450	77	26½	19,100 B. & W.	Camden, N.J.	1906	1908	9–4 K.S.	3	7 K.S.	7 K.S.	12 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *7-in.*, 12 *3-in.*, 12 *3-pr.*, 4 *1-pr.*, 4 M., 2 l.	4 sub.	18·2 *t*	900 2350	916
Superposed turrets.	**New Jersey**	14,948	435	76¼	23¾ †	23,089 B. & W.	Quincy, Mass.	1904	1906	11–4 K.S.	3	6 K.S.	6 K.S.	11 K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 12 *6-in.*, 12 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 sub.	19·4 *t*	900 1900	812
b.	**New York** §	27,000	..	..	..	35,000	New York	Bldg	..	11–5 K.S.	3	9	..	11 K.S.	5 K.S.	10 *14-in.*, 22 *5-in.*	2 sub.	21·0	..	..
a c.	**North Carolina**	14,500	502	72¾	25	29,785 B. & W.	Newport News	1906	1908	5–3 K.S.	3	5 K.S.	9 K.S.	9 K.S.	5 K.S.	4 *10-in.*, 16 *6-in.*, 22 *3-in.*, 12 *3-pr.*, 4 *1-pr.*, 4 M., 2 l.	4 sub.	22·48 *t*	900 2000	845
b.	**North Dakota**	20,000	510	85	27	31,400 Cur. tur.	Quincy, Mass.	1908	1910	11 K.S.	..	10–8 K.S.	..	11 K.S.	5 K.S.	10 *12-in.*, 14 *5-in.*, 2 *3-pr.*, 2 l., 12 M.	2 sub.	21·6 *t*	1000 2500	960
t.	**Ohio**	12,440	388	72¼	25½	16,220 T.	S. Francisco.	1901	1904	11·4 K.S.	3–4	6 K.S.	10 K.S.	12 K.S.	6 K.S.	4 *12-in.*, 16 *6-in.*, 6 *3-in.*, 8 *3-pr.*, 6 *1-pr.*, 2 M., 2 l.	2 sub.	17·8 *t*	1000 2144	521
b.	**Oregon**	10,288	348	69¼	27½	11,037	S. Francisco.	1893	1896	18 H.S.	2¾	5 H.S.	17 H.S.	17 H.S.	10–5 H.S.	4 *13-in.*, 8 *8-in.*, 20 *6-pr.*, 2 *1-pr.*, 4 M.	..	16·8 *t*	400 1594	500
a.c.	**Pennsylvania**	13,680	502	69½	24½	28,600 Nic.	Philadelphia	1903	1905	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 14 *6-in.*, 18 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	2 sub.	22·4 *t*	900 2000	829
c.d.s. (2 t.)	**Puritan**	6060	290½	60	18½	3,700	Chester	1882 reblt.	1896	14–6 H.S.	2	..	..	14 H.S.	..	4 *12-in.*, 6 *4-in.*, 6 *6-pr.*, 2 *1-pr.*, 4 M.	..	12·4 *t*	307	230
Superposed	**Rhode Island**	14,948	435	76¼	23¾ †	20,310 B. & W.	Quincy, Mass.	1904	1906	11–4 K.S.	3	6 K.S.	6 K.S.	11 K.S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 12 *6-in.*, 12 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 sub.	19·0 *t*	900 1900	812
a.c.	**St. Louis**	9700	424	66	25½	27,264 B. & W.	Philadelphia (Cramp)	1905	1906	4 K.S.	3	4–3	..	4 K.S.	..	14 *6-in.*, 18 *14-pr.*, 12 *3-pr.*, 12 *1-pr.*, 10 M., 2 l.	..	22·3 *t*	650 1500	664
b.	**South Carolina**	16,000	450	80¼	24½	18,357 B. & W.	Philadelphia (Cramp)	1908	1909	11-9	3	8	10	10–8	8	8 *12-in.*, 22 *3-in.*, 2 *3-pr.*, 12 M., 2 l.	2 sub.	18·9 *t*	900 2200	669
a.c.	**South Dakota**	13,680	502	69½	24½	28,598 B. & W.	S. Francisco.	1904	1907	6–3½ K.S.	4	5 K.S.	4 K.S.	6 K.S.	5 K.S.	4 *8-in.*, 14 *6-in.*, 18 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	2 sub.	22·0 *t*	900 2000	829

† Mean draught. ‡ Including armour, but not armament. § Details uncertain.

UNITED STATES—ARMOURED SHIPS—Continued.

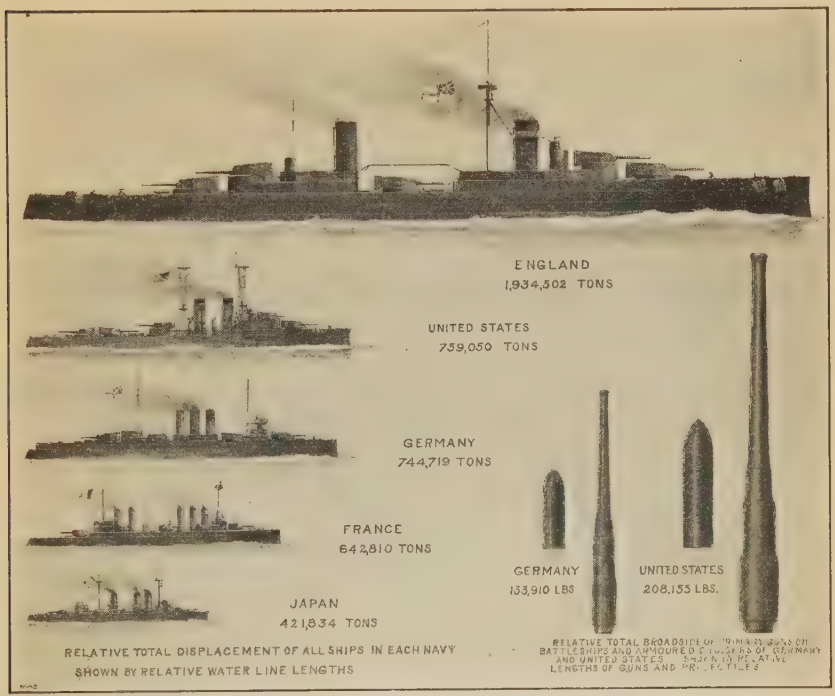
Class.	NAME.	Displacement.	Length.	Beam.	Draught.	Indicated Horse-Power.	Where Built.	Date of Launch.	Date of Completion.	Armour.						Armament.		Speed.	Normal Coal Supply.	Complement.
										Belt.	Deck.	Side above Belt.	Bulkhead.	Gun Position.		Guns.	Torpedo Tubes.			
														Heavy Guns.	Secondary.					
		tons.	ft.	ft.	ft.					in.	in.	in.	in.	in.	in.			knots.	tons.	
a.c.	**Tennessee**	14,500	502	72¾	25	26,963 B. & W.	Philadelphia	1904	1906	5–3 K.S.	3	5 K.S.	6 K.S.	9 K.S.	5 K.S.	4 *10-in.*, 16 *6-in.*, 22 *3-in.*, 12 *3-pr.*, 4 *1-pr.*, 8 M., 2 l.	4 sub.	22·1 *t*	900 2000	858
b.	**Texas** §	27,000	..	..	..	35,000	Newport News	Bldg.	..	11–5 K.S.	3	9 K.S.	..	11 K.S.	5 K.S.	10 *14-in.*, 22 *5-in.*	2 sub.	21 0	..	..
b.	**Utah**	21,825	510	88½	28½	28,000 tur.	Camden, N.J.	1909	..	11	..	10	..	11	5	10 *12-in.*, 16 *5-in.*, 4 *3-pr.*, 4 M., 2 l.	2 sub.	21·0	1000 2300	1014
t.	**Vermont**	16,000	450	77	26¾	17,982 B. & W.	Quincy, Mass.	1905	1907	8–11 K.S.	3–4½	8 K.S.	7 K.S.	10 K.S.	7 K.S.	4 *12-in.*, 8 *8-in.*, 12 *7-in.*, 20 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 sub.	18·33 *t*	900 2200	854
Super-posed	**Virginia**	14,948	435	76¼	23¾ †	22,841 Nic.	Newport News	1904	1906	11–8 K.S.	3	6 K.S.	6 K.S.	11 K S.	6 K.S.	4 *12-in.*, 8 *8-in.*, 12 *6-in.*, 12 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	4 sub.	19·0 *t*	900 1900	812
a.c.	**Washington**	14,500	502	72¾	27	27,152 B. & W.	Camden, N.J.	1905	1906	5–3 K.S.	3	5 K.S.	6 K.S.	9 K.S.	5 K.S.	4 *10-in.*, 16 *6-in.*, 22 *3-in.*, 12 *3-pr.*, 4 *1-pr.*, 8 M., 2 l.	4 sub.	22·3 *t*	900 2000	858
,,	**West Virginia**	13,680	502	69½	24½	26,135 B. & W.	Newport News	1903	1905	6–3½ K.S.	4	5 K.S.	12 H.S.	6 K.S.	5 K.S.	4 *8-in.*, 14 *6-in.*, 18 *3-in.*, 12 *3-pr.*, 8 *1-pr.*, 8 M., 2 l.	2 sub.	22·1 *t*	900 2000	829
t.	**Wisconsin**	11,653	368	72½	26	12,452	S. Francisco	1898	1901	16½–4 H.S.	3–4	5½ H.S.	..	15 H.S.	6 H.S.	4 *13-in.*, 14 *6-in.*, 16 *6-pr.*, 6 *1-pr.*, 4 M., 2 l.	1	17·2 *t*	800 1310	583
b.	**Wyoming**	26,000	554	93¼	28½	28,000 tur.	Philadelphia	Bldg.	..	11–9 K.S.	..	..	8–6 K S.	11 K S.	8	12 *12-in.*, 21 *5-in.*, 4 *3-pr.*, 2 M., 2 l.	2 sub.	20·5	1650 2500	1115
b.	**Two Battleships**	30,000	..	..	..	..	..	Pro.	..	11	..	10	..	11	5	12 *14-in.* §	..	21·0	....	..

Also the monitors Amphitrite, Miantonomoh, Monadnock, and Terror, 3990 tons, Tonopah (*ex* Nevada), 3714 tons, Talahasse (*ex* Florida) and Ozark (*ex* Arkansas), 3235 tons, Cheyenne (*ex* Wyoming), 3218 tons, and the second-class battleship Texas, 6315 tons.

Courtesy of "Brassey's Naval Annual," 1912. † Mean draught. ‡ Including armour, but not armament. § Details uncertain.

MODIFIED WHITEHEAD TORPEDO. (Page 411.)

P. Plunger or striking rod g. Safety-pin. C. Guncotton charge. D. Detonating charge. B. Air-flask. J. Charging valve. K. Hydrostatic valve. H. Pendulum. M. Turbine. N. Submergence control mechanism. S. Submergence valve. S. H. Superheater. K. Valve case. Y. Air lever. O. Immersion servo-motor. L. Pressure regulator. V. Gyroscope. T. Gyroscope impulse. U. Servo-motor. G. V. Rudders for horizontal control. G. H. Rudders for vertical control. F. and G. Rudder controls. E. E. Propeller shaft. I. I. Propellers. R. Shaft gearing. A. After-body. L. B. Ballast.



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GRAPHIC COMPARISON OF THE RELATIVE STRENGTH OF THE WORLD'S NAVIES.

The greater gun power of the U. S. Navy as compared with that of Germany is due to our pre-Dreadnought ships carrying heavier guns in the main batteries. Future sea-fights will be fought with Dreadnoughts. At the present rate of construction, Germany, in 1917, will possess twice as many Dreadnoughts as the United States.

LIST OF SHIPS OF THE UNITED STATES NAVY.

CRUISERS, FIRST CLASS.

Brooklyn[a]	9,215	3,368	400 6	64 8	26 6	21.91	20	12	[d] 1,350	July 92	Navy yard, Philadelphia.
Charleston[a]	9,700	.....	424 0	66 0	24 10	22.04	14	22	[d] 1,776	June 00	Navy yard, Puget Sound.
Milwaukee	9,700	[e] 3,401	424 0	66 0	24 10	22.22	14	22	[d] 1,704	...do.....	Do.
Saratoga[a]	8,150	2,838	380 6	64 10	26 4	21.00	14	12	[d] 1,075	Sept. 88	Asiatic Fleet.
St. Louis	9,700	.....	424 0	66 0	24 10	22.13	14	22	[d] 1,757	June 00	Training Station, San Francisco.

[a] Fitted as flagship.

[d] To 6 inches below beams.
[e] Subject to possible change.

The "Neptune," one of the largest colliers in the world, has been accepted by the Government and put into commission. High-speed marine turbines will be installed as soon as they are ready.

CRUISERS, SECOND CLASS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions. Length on L. W L.	Beam on L. W. L.	Draft aft at designed full load.	Speed (trial).	Guns of 4 inches and over.	Guns under 4 inches.	Coal capacity bunkers (maximum).	Date authorized.
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*			*Tons.*	
Baltimore	4,413	1,706	327 6	48 7½	24 5	20.10	12	4	1,079	Aug. 86
Chicago [a]	4,500	[b] 1,560	325 0	48 2½	22 0	[c] 18.00	18	9	[d] 850	Mar. 83
Columbia	7,350	2,536	411 7	58 2	24 6	22.80	11	12	[d] 1,525	June 90
Minneapolis [a]	7,350	2,537	411 7	58 2	24 6	23.07	11	12	[d] 1,400	Mar. 91
Newark [a]	4,083	[b] 1,438	311 5	49 2	22 4	[c] 19.00	12	6	[d] 800	Mar. 85
Olympia [a]	5,865	[b] 1,896	340 0	53 0½	25 0	21.69	14	4	[d] 1,000	Sept. 88

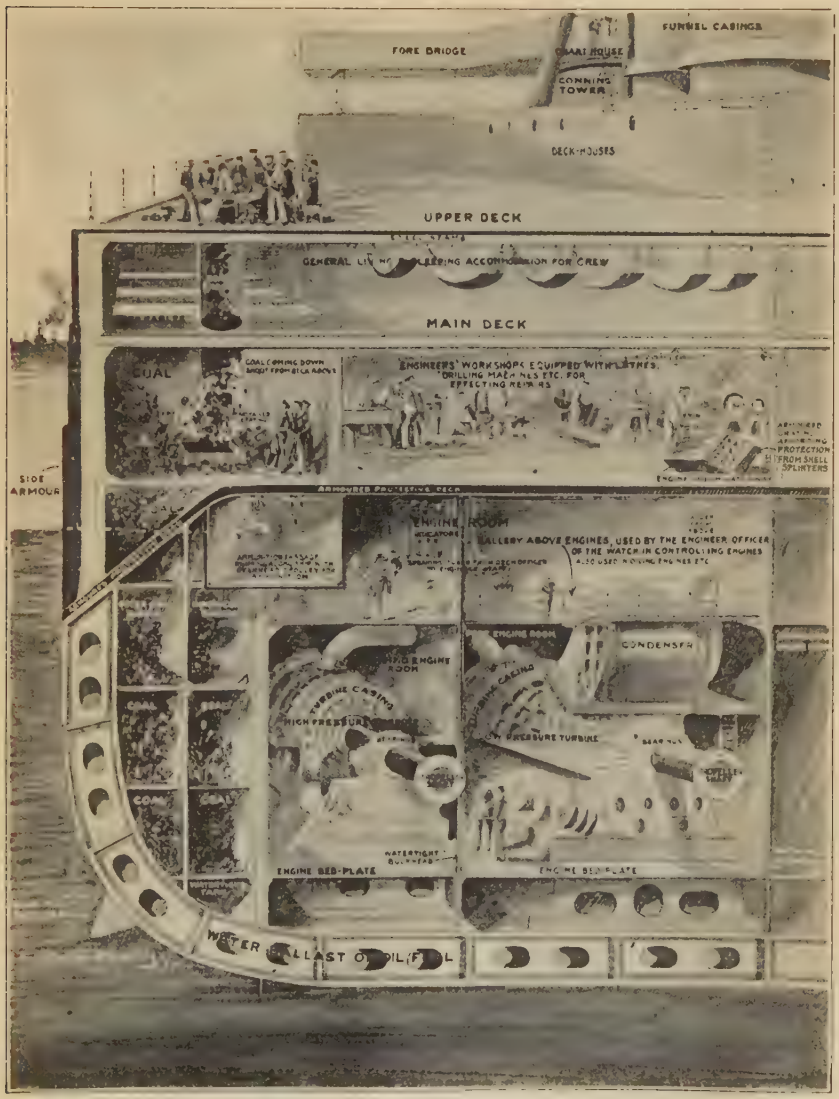
CRUISERS, THIRD CLASS.

Albany	3,430	[b] 1,121	346 0	43 9	19 1	20.52	10	8	821	.....
Birmingham	3,750	.....	420 0	47 1	18 9	24.33	2	[e] 8	1,400	Apr. 04
Boston	3,000	[b] 1,280	277 5	42 2	20 10	15.60	6	6	[d] 428	Mar. 83
Chattanooga	3,200	.....	292 0	44 0	17 0	16.65	10	8	[d] 732	Mar. 99
Chester	3,750	.....	420 0	47 1	18 9	26.52	2	[e] 8	1,375	Apr. 04
Cincinnati	3,183	[b] 934	300 0	42 0	19 6	19.91	11	6	[d] 575	Sept. 88
Cleveland	3,200	.....	292 0	44 0	17 0	16.45	10	8	[d] 675	Mar. 99
Denver	3,200	1,566	292 0	44 0	17 0	16.75	10	8	[d] 675	Mar. 99
Des Moines	3,200	.....	292 0	44 0	17 0	16.65	10	8	[d] 700	Mar. 99
Galveston	3,200	.....	292 0	44 0	17 0	16.41	10	8	[d] 724	Mar. 99
Marblehead	2,072	[b] 626	257 0	37 0	16 3	18.44	8	4	[d] 346	Sept 88
New Orleans	3,430	[b] 1,130	346 0	43 9	19 1	[c] 20.00	10	8	[d] 750	.....
Raleigh	3,183	[b] 934	300 0	42 0	19 6	21.12	11	6	[d] 575	Sept 88
Salem	3,750	.....	420 0	47 1	18 9	25.92	2	[e] 8	1,400	Apr. 04
Tacoma	3,200	1,554	292 0	44 0	17 0	16.58	10	8	710	Mar. 99

TORPEDO-BOAT DESTROYERS.

Ammen	742	.....	289 0	26 1½	.....	30.48	[f] 3	5	.....	Mar. 09
Bainbridge	420	229	245 0	23 1	9 4	28.45	[g] 2	7	[d] 169	May 98
Barry	420	229	245 0	23 1	9 4	28.13	[g] 2	7	[d] 169	May 98
Burrows	742	.....	289 0	26 1½	.....	30.67	[f] 3	5	.....	May 08
Chauncey	420	229	245 0	23 1	9 4	28.64	[g] 2	7	[d] 169	May 98
Dale	420	229	245 0	23 1	9 2	28.00	[g] 2	7	[d] 174	May 98
Decatur	420	229	245 0	23 1	9 2	28.10	[g] 2	7	[d] 174	May 98
Drayton	742	.....	289 0	26 1½	9 6	30.83	[f] 3	5	[h] 70,500	May 08
Flusser	700	.....	289 0	26 0	10 0	30.41	[g] 3	5	303	May 07
Hopkins	408	.....	238 9	23 1½	10 5	29.02	[g] 2	8	143	May 98
Hull	408	.....	238 9	23 1½	10 3	28.04	[g] 2	8	143	May 98
Lamson	700	.....	289 0	26 0	10 7	28.61	[g] 3	5	284	June 06
Lawrence	400	.....	240 7	22 2½	9 5	28.41	[g] 2	7	[d] 108	May 98
Macdonough	400	.....	240 7	22 2½	9 5	28.03	[g] 2	7	[d] 108	May 98
Mayrant	742	.....	289 0	26 1½	.....	30.22	[f] 3	5	[h] 73,583	May 08
McCall	742	.....	289 0	26 1½	.....	30.66	[f] 3	5	.....	May 08
Monaghan	742	.....	289 0	26 1½	.....	30.45	[f] 3	5	[h] 70,074	May 09
Patterson	742	.....	289 0	26 1½	.....	29.69	[f] 3	5	[h] 71,457	Mar. 09
Paulding	742	.....	289 0	26 1½	9 6	32.80	[f] 3	5	[h] 70,580	May 08
Paul Jones	420	[b] 229	245 0	23 1	8 11	28.91	[g] 2	7	168	May 98
Perkins	742	.....	289 0	26 1½	10 1	29.76	[f] 3	5	[h] 73,815	May 08
Perry	420	[b] 229	245 0	23 1	8 11	28.32	[g] 2	7	[d] 168	May 98
Preble	420	[b] 229	245 0	23 1	8 11	28.03	[g] 2	7	[d] 168	May 98
Preston	700	.....	289 0	26 0	10 11	29.18	[g] 3	5	[d] 271	June 06
Reid	700	.....	289 0	26 0	10 0	31.82	[g] 3	5	[d] 303	Mar. 07
Roe	742	.....	289 0	26 1½	10 11	29.60	[f] 3	5	[h] 70,074	May 08
Smith	700	.....	289 0	26 0	10 7	28.35	[g] 3	5	[d] 286	June 06
Sterett	742	.....	289 0	26 1½	10 1	30.37	[f] 3	5	[h] 73,815	May 08
Stewart	420	.....	245 0	23 1	9 2	29.69	[g] 2	7	[d] 172	May 98
Terry	742	.....	289 0	26 1½	10 11	30.24	[f] 3	5	[h] 70,074	May 08
Trippe	742	.....	289 0	26 1½	.....	30.89	[f] 3	5	[h] 70,580	Mar. 09
Truxtun	433	.....	248 0	22 3½	9 10	29.58	[g] 2	8	[d] 173	May 98
Walke	742	.....	289 0	26 1½	.....	29.78	[f] 3	5	[h] 67,817	Mar. 09
Warrington	742	.....	289 0	26 1½	.....	30.12	[f] 3	5	[h] 73,583	May 08
Whipple	433	.....	248 0	22 3½	9 10	28.24	[g] 2	8	[d] 173	May 98
Worden	433	.....	248 0	22 3½	9 10	29.86	[g] 2	8	[d] 173	May 98

[a] Fitted as a flag ship.
[b] Subject to possible change.
[c] Estimated.
[d] Capacity to 0″ below beams.
[e] Two torpedo tubes.
[f] Twin 18-inch Whitehead torpedo tubes (long).
[g] Eighteen-inch Whitehead torpedo tubes (long).
[h] Oil fuel, gallons.



Courtesy of "The Illustrated London News."

THE ENGINE SECTION OF A TURBINE DRIVEN "SUPER-DREADNOUGHT."

MONITORS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions. Length on L. W. L.	Beam on L. W. L.	Draft aft at designed full load.	Speed (trial).	Guns of 4 inches and over.	Guns under 4 inches.	Coal capacity bunkers (maximum).	Date authorized.
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*			*Tons.*	
Amphitrite	3,990	.....	259 3	55 4	14 8	10.50	6	2	[b] 271	Aug. 86
Cheyenne	3,225	.....	252 0	50 0	13 3	11.80	6	3	[b c] 129	May 98
Miantonomoh	3,990	.....	260 3	55 4	15 0	10.50	4	2	[b] 250	Aug. 86
Monadnock	3,990	[a] 988	258 6	55 5	14 8	11.63	6	5	[b] 386	Aug. 86
Monterey	4,084	[a] 840	256 0	59 0½	15 4	13.60	4	6	[b] 206	Mar. 87
Ozark	3,225	.....	252 0	50 0	13 3	12.03	6	3	[b] 344	May 98
Puritan	6,060	.....	290 3	60 1½	18 3	12.40	10	6	[b] 306	Aug. 86
Tallahassee	3,225	.....	252 0	50 0	13 3	12.40	6	3	[b] 355	May 98
Terror	3,990	.....	258 8	55 6	14 8	10.50	8	2	[b] 276	Aug. 86
Tonopah	3,225	.....	252 0	50 0	13 3	13.04	6	3	[b] 338	May 98

TORPEDO BOATS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions. Length on L. W. L.	Beam extreme.	Mean draft.	Speed (trial).	Guns of 4 inches and over.	Guns under 4 inches.	Coal capacity bunkers (maximum).	Date authorized.
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*			*Tons.*	
Bagley	175	68	157 0	17 7½	4 11	29.15	[d] 3	3	43	May '98
Bailey	280	.....	205 0	19 3	6 10	30.20	[e] 2	4	99	Mar. 97
Barney	175	68	157 0	17 7½	4 11	29.04	[d] 3	3	43	May 98
Biddle	175	68	157 0	17 7½	4 11	28.57	[d] 3	3	43	May 98
Blakely	196	.....	175 1	17 9	5 11	25.58	[d] 3	3	72	May 98
Craven	146	.....	147 0	16 4½	4 7	30.00	[e] 2	4	[f] 32	June 96
Cushing	105	.....	138 9	14 3	4 10	22.50	[e] 2	3	36	Aug. 86
Dahlgren	146	.....	147 0	16 4½	4 7	30.00	[d] 2	4	[f] 32	June 96
Davis	154	.....	146 0	15 4	5 10	23.41	[e] 3	3	40	June 96
De Long	196	.....	175 1	17 9	5 11	25.52	[d] 3	3	72	May 98
Dupont	165	.....	175 0	17 8½	4 8	28.58	[d] 3	4	76	Mar. 95
Ericsson	120	.....	149 7	15 6	4 9	22.62	[e] 2	4	36	June 90
Farragut	279	[a] 160	213 6	20 8	6 0	30.13	[e] 2	4	95	June 96
Foote	142	.....	160 0	16 1	5 0	24.53	[d] 2	3	44	July 94
Fox	154	.....	146 0	15 4	5 10	23.13	[d] 3	3	40	June 96
Goldsborough	255	.....	198 0	20 7	6 10	27.40	[d] 2	4	89	Mar. 97
Gwin	46	.....	99 6	12 6	3 3	20.88	[e] 2	1	9	June 96
McKee	65	.....	99 3	12 9	4 3	19.82	[e] 2	2	.....	June 96
Mackenzie	65	.....	99 3	12 9	4 3	20.11	[e] 2	1	[f] 15	June 96
Manly	30	.....	60 8	9 5	2 11	17.00	.....	.....	.....	.....
Morris	105	.....	138 3	15 6	4 1	24.00	[d] 3	3	26	June 96
Porter	165	.....	175 0	17 8½	4 8	28.63	[d] 3	3	70	Mar. 95
Rodgers	142	.....	160 0	16 1	5 0	24.49	[d] 3	3	44	July 94
Rowan	210	.....	170 0	17 0	5 11	27.07	[d] 2	4	63	Mar. 95

[a] Subject to possible change.
[b] Capacity to 6 inches below beams.
[c] Also 60,816 gallons fuel oil.
[d] Eighteen-inch Whitehead torpedo tubes (long).
[e] Eighteen-inch Whitehead torpedo tubes.
[f] Estimated.

TORPEDO BOATS—Continued.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions.			Speed (trial).	Guns of 4 inches and over.	Guns under 4 inches.	Coal capacity bunkers (maximum).	Date authorized.
			Length on L. W. L.	Beam extreme.	Mean draft.					
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*			*Tons.*	
Shubrick	200	104	175 0	17 6	5 2	26.07	[a] 3	3	82	May 98
Somers	150	.....	149 4	17 6	5 10	[b] 17.50	....	....	37	.....
Stockton	200	104	175 0	17 6	5 2	25.79	[a] 3	3	79	May 98
Stringham	340	.....	225 0	22 0	6 6	25.33	[a] 2	4	95	Mar. 97
Talbot	46	.....	99 6	12 6	3 3	21.15	[a] 2	1	8	.....
Thornton	200	104	175 0	17 6	5 2	24.88	[a] 3	3	85	May 98
Tingey	165	103	175 0	17 6	4 8	24.94	[a] 3	3	73	...do ....
Wilkes	165	.....	175 0	17 7½	4 8	25.99	[a] 3	3	66	...do ....

Table of Submarines built will be found on page 586.

TENDERS TO TORPEDO VESSELS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions.			Speed (trial).	Guns of 4 inches and over.	Guns under 4 inches.	Coal capacity bunkers (maximum).
			Length on L. W. L.	Beam extreme.	Mean draft.				
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*			*Tons.*
Alert [e]	1,110	[c] 713	177 4	32 0	13 0	10.00	6	4	197
Castine	1,177	[c] 398	204 0	32 1½	12 0	16.03	....	....	210
Dixie	6,114	[c] 3,074	391 6	48 3	19 11	[b] 14.50	....	12	1,075
Fortune	450	.....	137 0	26 0	9 6	10.00	....	....	108
Iris	[b] 6,100	[c] 1,923	310 6	39 0	24 0	10.00	....	....	300
Mohican	1,900	.....	216 0	37 0	16 6	.....	....	4	168
Pompey	3,085	.....	245 0	33 6	15 10	10.50	....	....	200
Severn	1,175	[c] 865	175 0	37 0	16 6	(d)	....	....	.....

[a] Eighteen-inch Whitehead torpedo tubes, long. [c] Subject to possible change. [e] Fitting out.
[b] Estimated. [d] No propulsive machinery.

PAY IN THE UNITED STATES NAVY.

The yearly pay of commissioned officers of the United States Navy is as follows: Admiral, $13,500; Rear-Admirals, first nine, $8,000; Rear-Admirals, second nine, or Commodores, $6,000; Captains, $4,000; Commanders, $3,500; Lieutenant Commanders, $3,000; Lieutenants, $2,400; Lieutenants (junior grade) $2,000; Ensigns, $1,700; Midshipmen (at Naval Academy) $500; Midshipmen (after Grad.), $1,400. All officers below the rank of Rear-Admiral are entitled to 10 per cent. increase upon the full yearly pay of their grades for each and every period of five years' service as "longevity pay" provided that the total amount of such increase shall not exceed 40 per cent. upon the full yearly pay of their grade. All officers receive 10 per cent. additional for sea duty, or shore duty beyond continental limits of the United States, except Porto Rico and Hawaii.

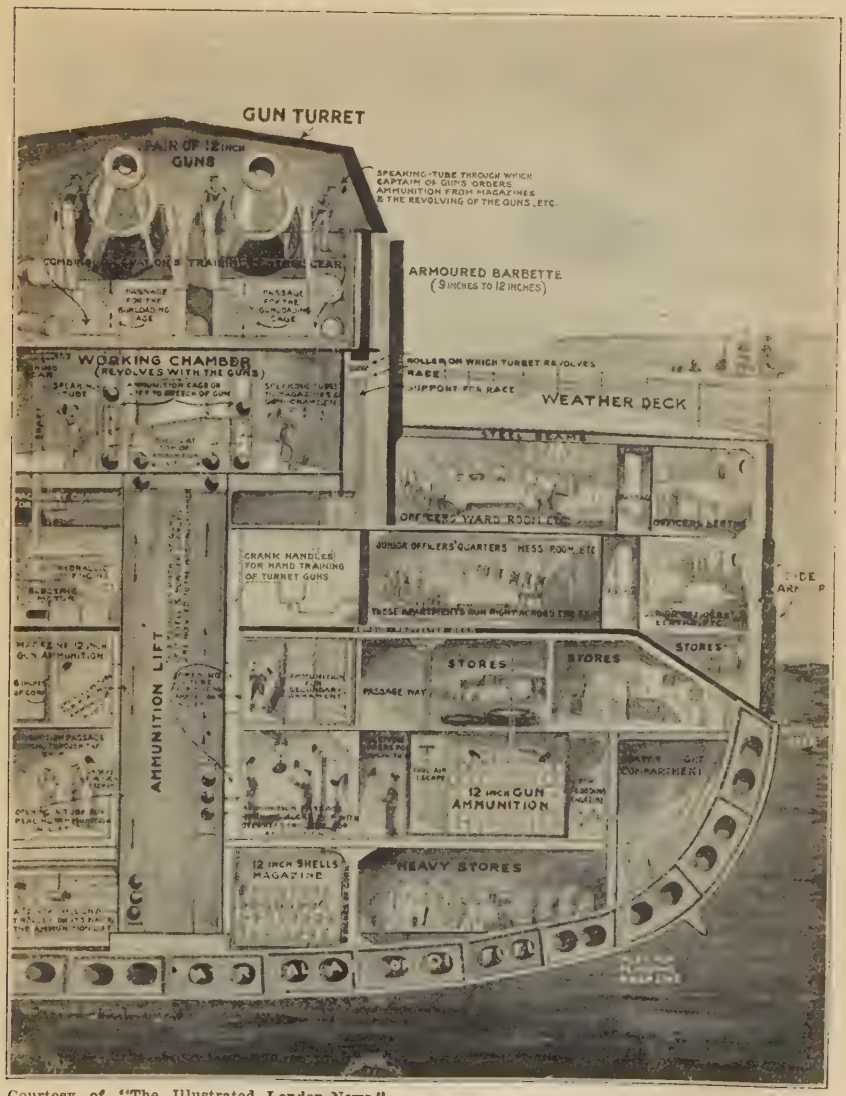
GUNBOATS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions. Length on L. W. L.	Dimensions. Beam.	Dimensions. Draft aft at designed fire load.	Speed.	Guns of 4 inches and over.	Guns under 4 inches.	Coal capacity bunkers.
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*			*Tons.*
Alvarado	100	.....	110 0	15 6	5 10	[b] 9.00	....	[c] 4	16
Annapolis	1,010	[a] 560	168 0	36 0	12 9	13.17	....	6	230
Callao	243	.....	115 3	17 10	7 6	[b] 10.00	....	6	33
Concord	1,710	[a] 481	230 0	36 0	16 3	16.80	4	4	354
Dolphin	1,486	[a] 447	240 0	32 0	17 0	15.50	2	5	265
Don Juan de Austria.	1,130	[a] 366	210 0	32 0	15 8	12.20	2	[c]10	204
Dubuque	1,085	568	174 0	35 0	13 4	12.90	6	6	246
Elcano	620	.....	157 11	26 0	12 0	[b] 11.00	4	....	94
Helena	1,392	[a] 921	250 9	39 8	10 0	15.50	8	[c] 4	300
Isla de Cuba	1,030	[a] 314	192 10	30 1½	12 0	13.08	2	[c] 8	159
Isla de Luzon	1,030	[a] 314	192 10	30 1½	12 0	11.23	4	[c] 6	159
Machias	1,177	[a] 398	204 0	32 1½	13 7	15.46	8	4	261
Marietta	990	[a] 532	174 0	34 0	12 10	13.02	6	6	229
Nashville	1,371	[a] 756	220 0	38 1½	12 7	16.30	8	6	363
Newport	1,010	[a] 560	168 0	36 0	12 9	12.29	....	....	224
Paducah	1,085	568	174 0	35 0	13 4	12.85	6	6	[d] 236
Pampanga	243	.....	115 3	17 10	7 6	[b] 10.00	....	6	33
Panay	170	.....	94 10	17 3	7 6	[b] 8.00	....	3	20
Petrel	890	362	181 4	31 0	12 10	11.40	4	4	193
Princeton	1,010	[a] 560	168 0	36 0	12 9	10.64	6	6	226
Quiros	350	.....	137 9	22 9	9 3	[b] 11.00	....	4	78
Ranger	1,261	.....	177 4	32 0	.....	10.00	....	....	178
Samar	243	.....	115 3	17 10	7 6	[b] 10.50	....	6	33
Sandoval	100	.....	110 0	15 6	5 10	[b] 8.00	....	3	16
Vicksburg	1,010	[a] 560	168 0	36 0	12 9	12.71	6	6	243
Villalobos	370	.....	148 0	23 0	9 0	[b] 11.00	....	6	65
Wheeling	990	518	174 0	34 0	12 10	12.88	6	6	[d] 250
Wilmington	1,392	[a] 921	250 9	39 8	10 0	15.08	8	4	300
Yorktown	1,710	[a] 482	230 0	36 0	16 3	16.14	6	8	341

TRANSPORTS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions. Length on L.W.L.	Dimensions. Beam.	Dimensions. Mean draft.	Speed.	Guns, 4-inch and over.	Guns under 4 inches.	Coal capacity bunkers (maximum).	Carrying capacity. Officers.	Carrying capacity. Enlisted men.
	Tons	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*			*Tons.*		
Buffalo	6,000	.....	[e] 391 6	48 3	19 5	[b] 14.5	6	6	1,375	29	800
General Alava	1,115	.....	212 6	29 9	11 0	10.5	....	2	240	15	200
Prairie	6,620	.....	[e] 391 6	48 3	20 9	[b] 14.5	....	15	1,300	23	750
Rainbow	4,360	[a] 2,254	326 0	41 0	17 2	[b] 12.0	....	12	1,139	25	600
Yankee	6,225	.....	[e] 391 10	48 4	20 1	[b] 14.5	.....	.....	1,175	29	750
Yosemite	2,069	.....	[f] 240 0	[g] 33 0	17 3	[b] 16.0	....	2	371	.....	.....

[a] Subject to possible change.
[b] Estimated.
[c] Added temporarily, two 3-pounders, R, F.
[d] Capacity to bottom of beams.
[e] Fore side of stem to center rudder stock.
[f] Between perpendiculars.
[g] Moulded.


GUN TURRET
PAIR OF 12 INCH GUNS
SPEAKING-TUBE THROUGH WHICH CAPTAIN OF GUNS ORDERS AMMUNITION FROM MAGAZINES & THE REVOLVING OF THE GUNS, ETC.
ARMOURED BARBETTE (9 INCHES TO 12 INCHES)
WORKING CHAMBER (REVOLVES WITH THE GUNS)
ROLLER ON WHICH TURRET REVOLVES
RACE
SUPPORT FOR RACE
WEATHER DECK
OFFICERS' WARD ROOM, ETC.
OFFICERS' BERTHS
CRANK HANDLES FOR HAND TRAINING OF TURRET GUNS
JUNIOR OFFICERS' QUARTERS MESS ROOM, ETC.
AMMUNITION LIFT
STORES
STORES
PASSAGE WAY
12 INCH GUN AMMUNITION
12 INCH SHELLS MAGAZINE
HEAVY STORES

Courtesy of "The Illustrated London News."

THE GUN SECTION OF A "SUPER-DREADNOUGHT."

SUPPLY SHIPS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions. Length on L. W. L.	Beam.	Mean draft.	Speed.	Guns under 4 inches.	Coal capacity bunkers (maximum).	Cargo capacity.
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*		*Tons.*	*Tons.*
Celtic	8,000	.....	369 8	44 7	24 1	[a] 10.5	2	739	.....
Culgoa	6,000	2,483	334 4	43 0	21 9	13.25	2	957	.....
Glacier	8,325	.....	353 0	46 1	25 4	12.5	1	917	.....
Supply	4,325	[b] 2,692	342 7	43 4	19 5	9.66	10	1,029	.....

HOSPITAL SHIPS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions. Length on L. W. L.	Beam.	Mean draft.	Speed.	Guns under 4 inches.	Coal capacity bunkers (maximum).	Capacity for patients. Officers.	Men.
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*		*Tons.*		
Relief	3,300	.....	299 2	46 0	15 10	[a] 15.0	....	607	15	200
Solace	5,700	.....	361 2	44 0	22 0	[a] 15.0	....	1,000	9	234

FUEL SHIPS.

Name.	Displacement.	Net tonnage for Suez Canal.	Dimensions. Length over all.	Beam.	Mean draft, loaded.	Speed. Loaded.	Light.	Capacity. Bunker.	Cargo.
	Tons.	*Tons.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Knots.*		*Tons.*	*Tons.*
Abarenda	6,705	2,133	325 6	42 0½	22 10	[a] 9.00	9.5	813	3,400
Ajax	9,250	3,320	387 6	46 6	24 8	[a] 10.00	11	500	5,000
Alexander	6,181	.....	343 3	43 0	23 0	[a] 8.75	10	800	4,200
Arethusa	6,159	.....	332 0	42 2	20 11	[a] 10.00	.....	685	[d]
Brutus	6,600	[b] 2,314	332 6	41 6	23 1	[a] 10.00	.....	547	4,000
Cæsar	5,920	2,072	322 1	43 11	19 7	[a] 10.00	11	761	3,156
Cyclops	19,360	7,055	542 0	[c] 65 0	27 8	14.61	.....	2,233	[e] 10,457
Hannibal	4,000	.....	274 1	39 3	17 7	9.00	10	480	2,300
Hector	11,230	3,902	403 0	[c] 53 0	24 8	12.87	.....	818	8,128
Justin	.....	.....	287 6	39 0	19 8	9.08	10.9	167	2,900
Leonidas	4,023	.....	273 11	39 2½	17 7	8.5	9.5	200	2,200
Mars	11,230	3,902	403 0	[c] 53 0	24 8	12.65	.....	818	8,128
Nanshan	4,950	.....	300 0	39 0	21 3	10.5	11	400	2,900
Neptune	19,531	.....	542 0	[c] 65 0	27 7	12.93	.....	2,000	[e] 10,500
Nero	6,360	[b] 2,204	320 0	41 0	22 0	[a] 9.00	.....	300	3,500
Prometheus	12,585	4,350	465 9	60 1	26 0	[a] 16.00	.....	1,576	6,410
Saturn	[f] 6,220	.....	297 1	40 0	22 1	11.00	.....	[g] 386	2,400
Sterling	[f] 5,663	.....	284 0	37 0	22 6	11.00	11	469	2,672
Vestal	12,585	.....	465 9	60 1	26 0	[a] 16.00	.....	[g] 1,648	6,134
Vulcan	11,230	3,902	403 0	[c] 53 0	24 8	12.82	.....	818	8,128

[a] Estimated.
[b] Subject to possible change.
[c] Moulded.
[d] 1,085,000 gallons fuel oil.
[e] Also 375,000 gallons fuel oil.
[f] Approximate.
[g] Capacity to bottom of beams.

LIST OF SHIPS OF THE UNITED STATES NAVY.

UNDER CONSTRUCTION.

Name.	Displacement (tons).	Type.	Hull.	I. H. P.	Propulsion.	Guns (main battery).	Place where building.
Arkansas	26,000	Battleship	S.	28,000	4 screws	33	New York Ship Building Co., Camden, N. J.
Wyoming	26,000	do	S.	28,000	4 screws	33	Wm. Cramp & Sons, Philadelphia.
New York	27,000	do	S.	32,000	T. S.	31	Navy yard, New York.
Texas	27,000	do	S.	32,000	T. S.	31	Newport News Ship Building Co.
Nevada	a27,500	do	S.	a 24,800	T. S.	31	Fore River Ship Building Co., Quincy, Mass.
Oklahoma	a27,500	do	S.	a 24,800	T. S.	31	New York Ship Building Co., Camden, N. J.
Fanning	742	Destroyer	S.	12,000	3 screws	5	Newport News Ship Building Co.
Jarvis	742	do	S.	12,000	3 screws	5	New York Ship Building Co., Camden, N. J.
Henley	742	do	S.	12,000	T. S.	5	Fore River Ship Building Co., Quincy, Mass.
Beale	742	do	S.	12,000	3 screws	5	Wm. Cramp & Sons, Philadelphia.
Jouett	742	do	S.	12,000	3 screws	5	Bath Iron Works, Bath, Me.
Jenkins	742	do	S.	12,000	3 screws	5	Do
Cassin	1,010	do	S.	16,000	T. S.	5	Do.
Cummings	1,010	do	S.	16,000	T. S.	5	Do.
Downes	1,073	do	S.	16,000	T. S.	5	New York Ship Building Co., Camden, N. J.
Duncan	1,014	do	S.	16,000	T. S.	5	Fore River Ship Building Co., Quincy, Mass.
Aylwin	1,036	do	S.	16,000	T. S.	5	Wm. Cramp & Sons, Philadelphia.
Parker	1,036	do	S.	16,000	T. S.	5	Do.
Benham	1,036	do	S.	16,000	T. S.	5	Do.
Balch	1,036	do	S.	16,000	T. S.	5	Do.
Jupiter	19,360	Collier	S.	a 7,200	T. S.	.....	Navy yard, Mare Island.
Proteus	19,000	do	S.	.....	.....	.....	Newport News Ship Building Co.
Nereus	19,000	do	S.	.....	.....	.....	Do.
Orion	19,132	do	S.	.....	.....	.....	Maryland Steel Co., Sparrows Point, Md.
Jason	19,132	do	S.	.....	.....	.....	Do.
Gunboat No. 16	.....	Gunboat	S.	.....	.....	.....	Contract not yet awarded.
Sacramento	.....	do	.....	.....	.....	.....	Do.
Monocacy	.....	do	.....	.....	.....	.....	Do.
Niagara	.....	Submarine tender	.....	.....	.....	.....	Do.
E-1	.....	Submarine	.....	.....	.....	.....	Fore River Ship Building Co., Quincy, Mass.
E-2	.....	do	.....	.....	.....	.....	Do.
F-1	.....	do	.....	.....	.....	.....	Union Iron Works, San Francisco.
F-2	.....	do	.....	.....	.....	.....	Do.
F-3	.....	do	.....	.....	.....	.....	Seattle Construction & Dry Dock Co.
F-4	.....	do	.....	.....	.....	.....	Do.
G-1	.....	do	.....	.....	.....	.....	Lake Torpedo Boat Co., Bridgeport, Conn.
G-2	.....	do	.....	.....	.....	.....	Newport News Ship Building Co.
G-3	.....	do	.....	.....	.....	.....	Lake Torpedo Boat Co., Bridgeport, Conn.
G-4	.....	do	.....	.....	.....	.....	Wm. Cramp & Sons, Philadelphia.
H-1	.....	do	.....	.....	.....	.....	Union Iron Works, San Francisco.
H-2	.....	do	.....	.....	.....	.....	Do.
H-3	.....	do	.....	.....	.....	.....	Seattle Construction & Dry Dock Co.
K-1	.....	do	.....	.....	.....	.....	Fore River Ship Building Co., Quincy, Mass.
K-2	.....	do	.....	.....	.....	.....	Do.
K-3	.....	do	.....	.....	.....	.....	Union Iron Works, San Francisco.
K-4	.....	do	.....	.....	.....	.....	Seattle Construction & Dry Dock Co.
K-5	.....	do	.....	.....	.....	.....	Fore River Ship Building Co., Quincy, Mass.
K-6	.....	do	.....	.....	.....	.....	Do.
K-7	.....	do	.....	.....	.....	.....	Union Iron Works, San Francisco.
K-8	.....	do	.....	.....	.....	.....	Do.
Sonoma	1,120	Tug	S.	a 1,800	.....	.....	New York Ship Building Co., Camden, N. J.
Ontario	1,120	do	S.	a 1,800	.....	.....	Do.

a Estimated.

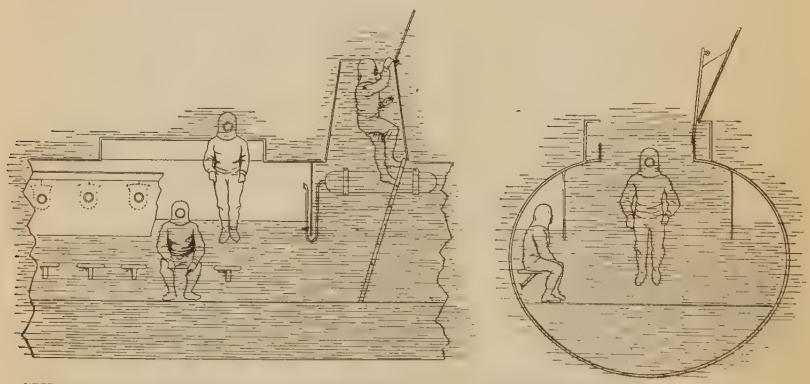
This table is of January 1, 1912; changes are constantly occurring. Thus the "Arkansas" was turned over to the Navy Department on August 29, 1912. The "Jouett" made 33.7 knots and is the fastest boat in the Navy.

The active list of the Navy, January 1, 1912, comprised 2,670 commissioned and 258 warrant officers, not including 722 Midshipmen at the Naval Academy. There were 780 commissioned and 123 warrant officers on the retired list. The enlisted strength allowed by law is 47,500 men and apprentice seamen.

UNITED STATES MARINE CORPS.

The United States Marine Corps, serving generally under the direction of the Secretary of War, is an independent branch of the military service of the United States. The corps may be detached by order of the President for service with the army but its principal duties are in connection with the navy as follows: To garrison the different navy yards and naval stations, both within and beyond the continental limits of the United States; to furnish the first line of mobile defense of naval bases and naval stations beyond the continental limits of the United States; to man such naval defenses, and to aid in manning, if necessary, such other defenses as may be erected for the defense of naval bases and naval stations beyond the continental limits of the United States: to garrison the Isthmian Canal Zone, Panama; to furnish such garrisons and expeditionary forces for duties beyond the seas as may be necessary in time of peace; to serve on board all battleships and armored cruisers of the navy, and such other vessels as may be directed, in detachments of not less than 8 per cent. of the strength of the enlisted men of the navy on said vessels; in case of disturbances in foreign countries marines are landed to protect American interests.

The authorized strength of the Marine Corps is 333 officers and 9,521 enlisted men. On June 30, 1911, there were 330 officers and 9,454 enlisted men in the service. The term of enlistment in the Marine Corps is four years and applicants must be 19 years of age and not over 35. Minors must have consent of parents or guardian. Apprentices to learn the drum and trumpet are enlisted between the ages of 15 and 17 with the consent of parents or guardian but they serve only during minority. All recruits must be able-bodied and of good character and after acceptance are sent to a recruit depot for instruction for three months.



SUBMARINE HELMET FOR THE ESCAPE OF IMPRISONED SAILORS IN SUBMARINES WHICH CANNOT RISE OR WHICH HAVE BEEN "HOLED." NOTE THE AIR TRAP.

SUBMARINE DISASTERS.

The important submarine disasters which have resulted in the loss of life are:

1904, March 13—British submarine "A1" sunk by collision off the Isle of Wight, England. 11 men killed.

1904, June 2—Russian submarine "Delfin" sank at her moorings in the Neva. 21 men drowned.

1905, February 10—British submarine "A5" blew up in Queenstown harbor. 4 men killed and 7 seriously injured.

1905, June 8—British submarine "A8" sank in Plymouth Sound. 15 men killed.

1905, July 6—French submarine "Fafardet" filled with water at Bizerte, Tunis, and could not rise. 12 men drowned.

1906, October 17—French submarine "Lutin" sank off Bizerta after an explosion. 15 men killed.

1909, April 26—Explosion aboard the Italian submersible Foca in the Bay of Naples. 8 men killed.

1909, June 13—Russian submersible "Kambala" rammed by warship off Sebastopol. 15 men killed.

1910, May 26—French submarine "Pluviose" struck by steamship. 28 men killed.

1910—Japanese submersible "No. 6" dived and could not get to the surface again. 15 men killed

1910, August 6—British submarine "A1" again suffered by an explosion whch mortally injured 7 men.

1911, January 18—German submersible "U3" struck on the bottom of the harbor of Kiel. 27 men shot to the surface in suits made for the purpose. Only 3 men killed.

1912, February 2—British submersible "A3" struck by ship off Isle of Wight. 14 men killed.

1912, June 8—French submarine "Vendémiare" run down by battleship St. Louis and sunk. 23 men killed.

UNITED STATES NAVAL ACADEMY.

NOMINATION.

The students of the Naval Academy are styled midshipmen. Two midshipmen are allowed for each Senator, Representative, and Delegate in Congress, two for the District of Columbia, and five each year from the United States at large. The appointments from the District of Columbia and five each year at large are made by the President. One midshipman is allowed from Porto Rico, who must be a native of that island. The appointment is made by the President, on the recommendation of the governor of Porto Rico. After June 30, 1913, each Senator, Representative, and Delegate in Congress will be allowed to appoint but one midshipman instead of two.

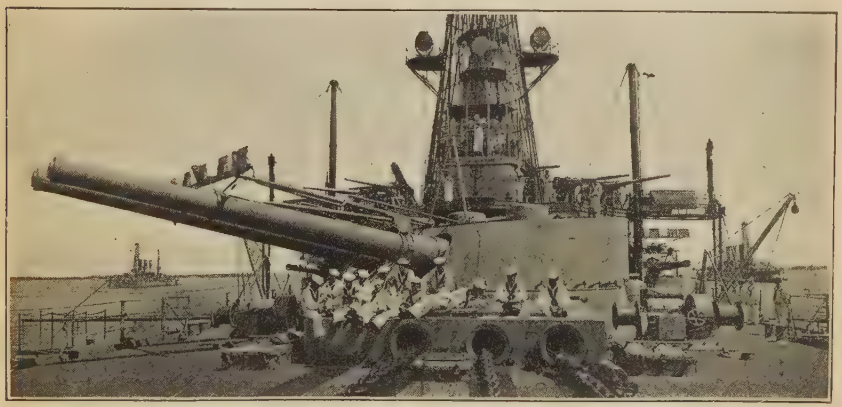
The course for midshipmen is six years—four years at the academy, when the succeeding appointment is made, and two years at sea, at the expiration of which time the examination for final graduation takes place.

Midshipmen who pass the examination for final graduation are appointed to fill vacancies in the lower grade of the line of the Navy; and occasionally to fill vacancies in the Marine Corps and in certain of the staff corps of the Navy.

Candidates allowed for congressional districts, for Territories, and for the District of Columbia must be actual residents of the districts or Territories, respectively, from which they are nominated. All candidates must at the time of their examination for admission, be between the ages of sixteen and twenty years. A candidate is eligible for appointment on the day he becomes sixteen and is ineligible on the day he becomes twenty years of age.

Candidates are required to be of good moral character, physically sound, well formed, and of robust constitution. Attention will also be paid to the stature of the candidate, and no one *manifestly* under size for his age will be received at the academy.

Full information in pamphlet form can be obtained by addressing the Secretary of the Navy, Washington, D. C.



FORWARD TURRET OF THE U. S. BATTLESHIP "MINNESOTA."

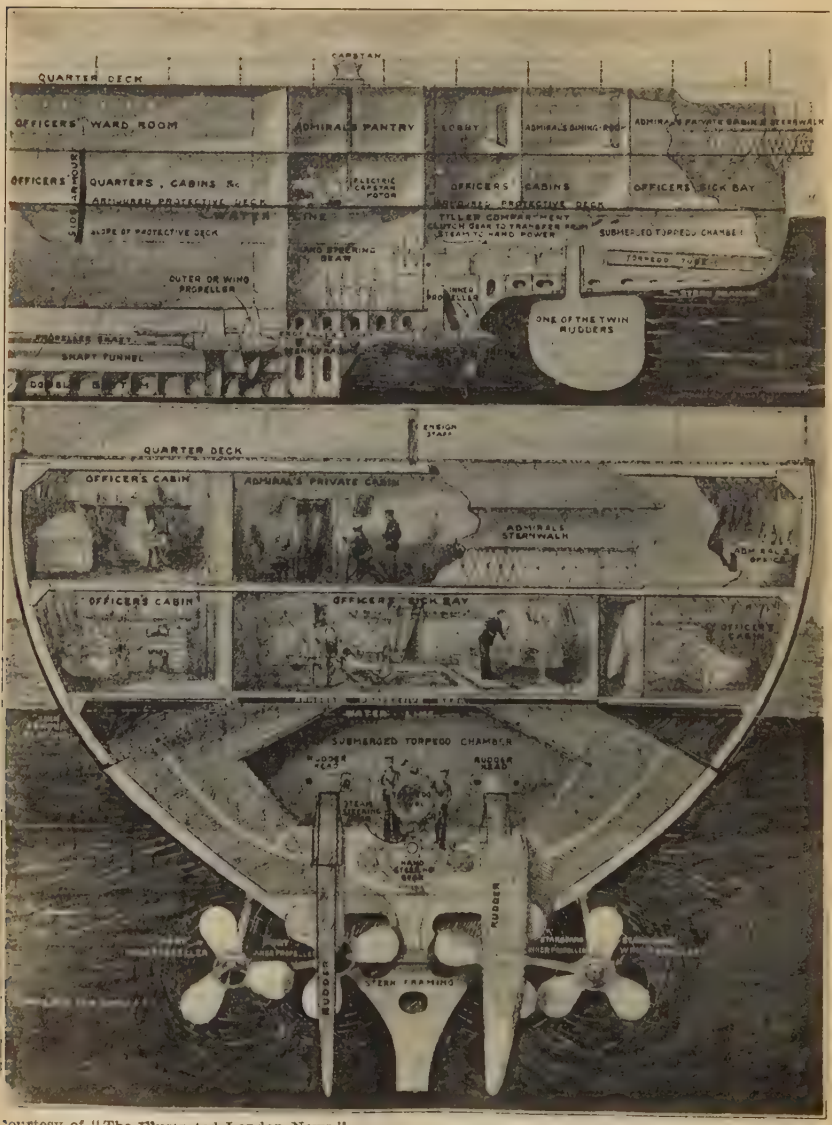
Above the 12-inch guns is the Morris tube and mechanism used in training gun-pointers.

NAVY AND NAVAL MILITIA.

At present there are 23 States and the District of Columbia supporting Naval Militia organizations aggregating a force of 602 officers and 6,592 men, a total of 7,194 militiamen, organized under the laws of the various States bordering upon the seas and upon the Great Lakes. The actual strength of the personnel of the Navy, on June 30, 1911, was 3,099 officers and 46,759 enlisted men, a total of 49,858. In the Marine Corps on June 30, 1911 there were 330 officers and 9,454 men, a total of 9,784 men.

COST OF SHIPS OF THE UNITED STATES NAVY.

The total cost of maintaining ships in commission during the fiscal year ending June 30, 1911 was $45,919,254. The average cost of ships of the Navy, taking as a basis the cost of ships completed to June 30, 1909, is as follows: Battleships, $6,096,928; armoured cruisers, $5,566,468; protected cruisers, $2,434,927. The cost of a battleship varies from 4 to 7½ million dollars; of an armoured cruiser from 4 to 6 million dollars, and of a protected cruiser from 1½ to 4 million dollars. The cost of the Battleships "New York" and "Florida" exclusive of armor and armament, authorized by the naval appropriation act approved July 24, 1910, was $6,400,000 each. The total cost of all the vessels of the Navy built and building under appropriations made to June 30, 1909, was $367,273,408.



Courtesy of "The Illustrated London News."

THE STERN SECTION OF A "SUPER-DREADNOUGHT."
Longitudinal above.—Transverse below.

CHAPTER XVI.

AVIATION.*

By Dr. A. F. Zahm.

EVOLUTION OF AIR CRAFT.

The science of aerial locomotion divides naturally into four parts—two relating to aerostation, or the science of buoyant air ships; two relating to aviation, or the science of flying machines. Each of these main branches may in turn be subdivided into two parts, one relating to power craft, the other to passive or motorless craft. Thus in aerostation we have power-driven or dirigible balloons, and we have free balloons which, being devoid of motive power, drift helplessly with the wind; while in aviation we have the various types of power-driven flying machines and the various forms of passive gliding or soaring machines, which travel through the air by the force of gravity, or by virtue of previously acquired momentum, or by the aid of favorable wind currents. These four branches all have their votaries, all have their specialized types of aerial vehicles; all save one form the basis of special and rapidly growing industries, involving, certainly in the case of power craft, millions of dollars of capital. The least successful of the four types of air craft is the soaring or gliding machine, because it has not yet received adequate attention; but when fully developed it may become of considerable importance among the various kinds of aerial locomotion. We shall consider briefly the growth and present status of these various popular and captivating modes of travel.

GROWTH OF PASSIVE BALLOONS.

The invention of the passive balloon is usually accredited to those two French brothers, Joseph and Stephen Montgolfier, who in June, 1783, first launched publicly a large paper bag inflated with hot air. But in truth they have to share the honor with several others. Prof. Charles, that same summer, constructed and publicly launched the first hydrogen balloon; Cavallo, in England, a year previously, made hydrogen soap bubbles which rose beautifully in the air; and Dr. Black, half a decade earlier, proposed to make a thin light vessel rise in the air by inflating it with hydrogen, a gas then recently discovered by Cavendish. The use of coal gas for inflation, constituting an important advance, though not an invention, was made in 1821 by George Green, of England.

The chief constructional features and navigation appliances of the practical gas balloon were devised or introduced by Prof. Charles and Mr. Green. Charles first covered the gas bag with a net from which the car or basket was hung by means of suspension ropes attached to a concentration ring at the bottom of the net. He invented the balloon valve and used it, together with sand ballast, to regulate his elevation. He also introduced the balloon anchor to arrest the balloon on reaching earth, the barometer for showing the altitude, dissolved rubber varnish to render the envelope impermeable. Green gave the balloon its modern net with small suspension ring, and first used the drag rope, trailing down from the basket along the earth's surface, to maintain an even altitude. After these two pioneers came John Wise, of America, who first used the ripping panel, a ribbon covering a vertical seam in the upper half of the envelope in such a way that, on landing, it can be quickly jerked off, to allow the bag to collapse on the ground instantly.

Some very large passive balloons have been made for amusement or scientific exploration, but these could

* Copyright 1912, Munn & Co., Inc.

FLIGHT OF DIRIGIBLE ACROSS COUNTRY.

easily be surpassed in size. The largest hot air balloon, *La Flesselle*, launched at Lyons in 1784, measured 100 feet in diameter by 130 feet high. Comparable with this in size was the hydrogen balloon, *The Prussia*, of 300,000 cubic feet volume, with which Prof. Berson and Dr. Süring rose to the highest elevation yet attained by man—35,600 feet, or nearly seven miles. The largest hydrogen balloon, cubing 450,000 feet and carrying forty passengers at once, was used by Giffard to give sightseers a view of Paris at the Exposition of 1878.

The longest voyage in a spherical balloon yet recorded is that of Emile Dubonnet and P. Dupont. Sailing from La Motte-Brenil, France, Jan. 7, 1912, they landed next day at Sokolowska, Russia, after a continuous journey of 1954 kilometers, or 1216 miles. The previous world's record was held by Count de la Vaulx. Starting from Vincennes, France, in October, 1900, he landed at Korosticheff, Russia, having traversed 1,193 miles in 35¾ hours. A close second to this record was made by A. R. Hawley in his spherical balloon *America*, aided by Augustus Post, in the Gordon Bennett International Balloon Race of 1910. Sailing from St. Louis, October 17, they drifted 1,173 miles from their starting point, and landed in a great forest at Peribonka River, North Lake Chilogoma, Canada, where they were lost for several days.

GROWTH OF POWER BALLOONS.

In the year succeeding the invention of the passive balloon the Robert brothers, who had been constructors for Prof. Charles, and had first made rubber varnish, devised and built the first elongated dirigible. This was a

melon-shaped silk bag, 52 feet long by 32 feet in diameter, supporting a longish car propelled by six silken oars and guided by a silk rudder. It was a successful dirigible, but too slow to be of any value, for it was driven by hand power and traveled at only a walking pace.

Gen. Meusnier that same year devised a similar shaped balloon, but having coaxial screw propellers between the car and bag, to be actuated by eighty men. The hull comprised a melon-shaped hydrogen bag inside a slightly larger air bag always pumped full and taut so as to resist deformation. Stablizing planes placed on the outside, as in the modern dirigible, were to control the poise of the vessel. The buoyant hull and suspended car were to be kept in alignment by suitably inclining and crossing the suspension cords. The Meusnier design was indeed a creation of fundamental importance which, for want of engine power, had to wait upwards of a century before it could be practically employed.

The first torpedo-shaped balloon was Jullien's model of 1850, made of gold beaters' skin, measuring 23 feet long and weighing 2½ pounds. It was driven by clock-spring-actuating twin propellers at either side of its bow, and had a double rudder at its stern. It could navigate steadily against a moderate wind. Aerodynamically this tiny model excelled in design all other dirigibles produced during the first century of aeronautics, and was the harbinger of the swift modern air cruisers of the most effective shape and equipoise.

During the remainder of the nineteenth century steam, electric and gas motors were in turn applied to the propulsion of airships, but with meager success. In 1852 Giffard, in a spindle-shaped balloon 143 feet long by 39 feet in diameter, and driven by a three-horse-power steam engine actuating an 11-foot screw, voyaged from Paris at a sustained speed of six miles an hour through the air and with good control. In 1872 the German Haenlein, with a cucumber-shaped coal gas balloon 164 feet long by 30 feet in diameter, driven by a gas engine taking fuel from the envelope, and actuating a single screw, attained a speed of ten miles per hour. In 1884 Renard and Krebs, in a torpedo-shaped dirigible 165 feet long by 27.5 in major diameter, driven by an electric battery motor, actuating a screw propeller, made the first return voyage against a moderate wind. The vessel showed excellent control, attained an average speed of 14.5 miles an hour, and was of model workmanship; but for lack of power it was practically abandoned till the advent of the automobile engine.

In 1898 Santos-Dumont, emulating the German Wölfert, who in 1880 first attempted to drive a dirigible with a benzine engine, sailed aloft in a spindle-shaped balloon 82 feet long by 11 feet in diameter, driven by a motor-cycle engine of 3½ horsepower, carried in the car suspended beneath the envelope. Finding this vessel manageable and swift enough to make his clothes flutter, and amply rigid when its balonet or internal air cell was properly inflated, he in subsequent years built fifteen more dirigibles of various designs. The speed of the best of these varied from fifteen to upwards of twenty miles per hour. They may be considered as the successful prototypes of the great non-rigid air cruisers which so quickly followed in France, Germany and elsewhere.

In 1900 Count Zeppelin, emulating the Austrian, Schwartz, who in 1897 first tentatively drove a rigid metal balloon with a petrol motor, launched the first of his huge rigid dirigibles. Its hull, which was framed of aluminum and contained seventeen compartments holding buoyant hydrogen bags, measured 416 feet long, 38 feet across, cubed 400,000 cubic feet, weighed nine tons, and had a displacement of ten tons. It was driven by two petrol engines actuating four screw propellers mounted directly on the underside of the hull, two forward and two aft. Subsequently larger vessels, with passenger compartments running along the bottom of the hulls, accommodating twenty to thirty passengers, were built and powered with engines adequate to attain velocities of over forty miles per hour. The large vessels have required for inflation nearly 700,000 cubic feet of hydrogen, have weighed some fifteen tons and lifted four or five tons of useful load, have voyaged continuously twenty to forty hours, and have made continuous journeys of 500 to 1,000 miles in length. *Zeppelin X.*, called the *Schwaben*, a regular transportation airship with accommodations for 24 passengers, made in

COUNT VON ZEPPELIN'S GREAT WORK EXPRESSED IN FIGURES.

Air-ship	Year	Gas capacity in cubic feet	Number of gas-tight compartments	Length in feet	Breadth in feet	Number of engines	Total horse-power	Number of pro-pellers	Speed in miles per hour
I.	1900	399,000	17	419.9	37.25	2	29.4	4	17.4
II.	1905–06	393,000	16	419.9	37.25	2	170	4	27 ?
III.	1906–07	399,000	16	419.9	37.25	2	170	4	28
	1908–09	427,300	17	446.2				4	29.2
	1912					2	210–230	4	33 ?
IV.	1908	547,400	17	446.2	42.65	2	210	4	27–29
V.	1909	547,400	17	446.2	42.65	2	210	4	28.6
VI.	1909–10	547,400	17	446.2	42.65	2	220	4	30.3
	1910	565,000	18	472.4	42.65	3	345	6	33.6
VII.	1910	681,600	18	485.6	45.93	3	345–360	4	32 ?
VIII.	1911	681,600	18	485.6	45.9	3	400	4	34.8
IX.	1911	600,000	16	433.1	45.9	3	400	4	35
		640,000	17	459.3			450–460		48
X.	1911	681,600	18	485.6	45.9	3	450–460		48
XI.	1912	681,600	18	485.6	45.9	3	450–460		44
									45

1911 over 100 trips, aggregating 8,500 miles and carried 2,300 persons. Regular excursion tickets can now be purchased in New York by outgoing tourists which, on presentation at the Zeppelin airport at Friedrichshafen, entitle the bearer to an airship voyage, usually conducted on schedule time, over some of the most beautiful and interesting regions of Germany and with the accommodations of a modern palace car. The above table gives the dimensions, power and speed of Count Zeppelin's various dirigibles up to 1912.

Rivaling these unique rigid dirigibles, at least in celerity and control, if not in size, are the great non-rigid dirigibles of Gross and of Parseval in Germany, of Clement and of Julliot in France, and of the national government in Italy. These all comprised elongated silk bags, more or less whale shaped, from which were suspended the car carrying the crew and passengers and the mechanism of propulsion and control. Scores of these large non-rigid dirigibles sprang into being for sportive or military use, powered sufficiently to run all day, to voyage hundreds of miles, and to attain speeds of thirty to forty miles an hour. The *Parseval* in particular has an excellent reputation for the speed and precision with which it carries passengers on schedule time above the city of Berlin and over some of the most interesting historical places in Germany.

GROWTH OF PASSIVE FLIERS.

For many decades two kinds of passive flight have been recognized in nature, and have been understood to be achievable by man. One is volplaning, or gliding by aid of gravity or acquired momentum; the other is soaring, or gliding by force of the wind without loss of altitude. Human volplaning has been so far perfected as no longer to be a novelty; human soaring is a much neglected art, though doubtless capable of very great development.

The permanent art of passive manflight dates from Otto Lilienthal's experiments near Berlin in the early nineties of the last century, though long previous to that time some wonderful feats of gliding and soaring, of both men and models, were reported by reliable witnesses. Lilienthal made numerous glides several hundred feet in length, down hill slopes, sometimes pausing in the air or rising considerably above his launching place. Sometimes also he wheeled about and returned nearly to his starting point. At first he used a monoplane glider, then a biplane, in each case controlling his poise in the air by shifting his weight as he hung by his arms underneath the kite-like motorless craft. He finally prepared to convert his glider into a dynamic aeroplane by

adding a light engine; but in an unlucky glide his structure gave way and dropped him to his death among its tangled wreckage—the protomartyr!

Lilienthal's work was continued by various disciples, mainly American, who perfected his structural designs and means of balance. Chanute and Herring in the latter nineties developed the familiar Chanute biplane, whose Pratt truss arrangement of two superposed concave surfaces is now commonly used in many types of power aeroplanes. They, too, maintained their aerial poise by shifting their suspended weight. Early in the twentieth century the Wright brothers, of Ohio, and Prof. Montgomery, of California, introduced in practice the modern dynamic system of controlling an aeroplane in passive flight without shift of the operator's weight, though, broadly speaking, their devices had been previously invented and published by various other votaries of aviation, as will be shown later.

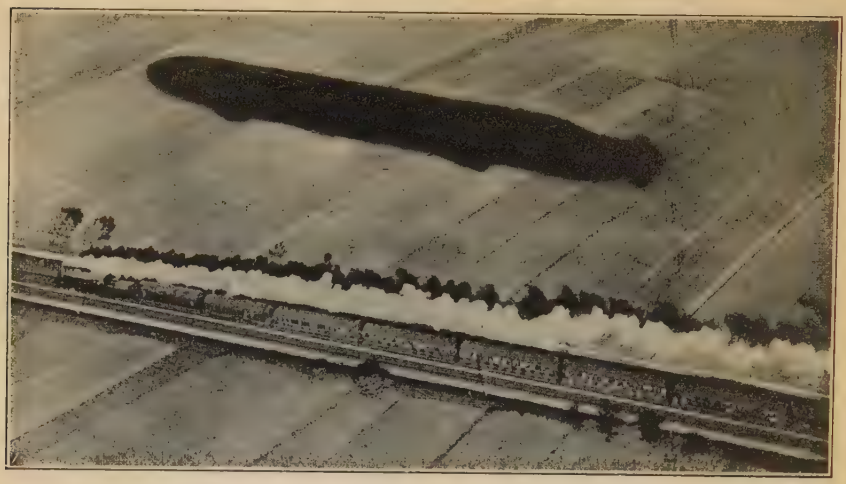
The records for volplaning have not been kept with much care, but some are well attested. Lilienthal, Chanute and Herring and the Wrights all performed short flights of usually less than 1,000 feet, along sloping ground. Montgomery in 1905 launched from a balloon 4,000 feet in air a glider bearing on its back a dauntless aeronaut, Maloney, who by means of wing warping and a double rudder guided it, with many a playful dip and wheel, securely down to a designated spot, where he landed in safety. With a like aerial glider another Montgomery aeronaut cut corkscrews in the air. The record for volplaning in a power machine, which really becomes a glider when the motor stops, is held by Lincoln Beachy, who during the Chicago meet of 1911, glided sheer down to earth in a Curtiss biplane from an elevation of 11,642 feet.

The records for soaring are briefer, and some are not so well attested. In 1859 Capt. Le Bris, piloting a glider patterned after an albatross, soared 300 feet high and descended safely to earth. This on the authority of De la Landelle, who wrote a history of aeronautics, published in 1884, and who had the account from Le Bris's neighbors. Mouillard, nearly twenty years ago, soared 138 feet over a prairie after an initial run and jump across a roadside ditch with a glider strapped to his waist. Many recent aeroplanists have been carried well upward by rising wind currents. During the gliding experiments of Chanute and Herring one of the operators was raised by the wind some forty feet high, then landed almost in his tracks without serious shock. Lateral glides along the hillside were also made, one forty-eight seconds in length, which showed the possibility of patrolling to and fro in such places. Mr. Atwood relates that while flying over a mountainous country he once encountered an upsloping current which lifted him over 1,000 feet high. Orville Wright was supported on such an ascending current above a hill slope for nearly ten minutes, sometimes stationary, again gliding forward or backward, and sometimes rising to a considerable elevation above the starting point. Mr. Ludolph Schroeder relates that in May, 1908, he launched from the Palisades, on the Hudson, a riderless glider six feet long, made of one-inch pine boards, and saw it caught up by the oncoming wind and carried hundreds of feet high and many thousand feet to the west of the river.

GROWTH OF POWER FLIERS.

From time immemorial aviation had been cultivated in a crude, tentative and unpromising fashion before any noteworthy and definite progress began to be recorded. Such progress dates from the first decade of the nineteenth century. Prior to that time many volant devices had been tested, and some little flying had been achieved, but no permanent and substantial contribution to either the science or art of dynamic flight had been transmitted to succeeding generations.

England made the first substantial contribution to the science of aviation. In 1809 and 1810 Sir George Cayley published in Nicholson's Journal, now the Philosophical Magazine, a paper describing his experiments with large aerial glider models, and setting forth the principles of design conducive to inherent stability. He clearly conceived and explained the advantage of placing the wings of an aeroplane at a dihedral angle to one another, as soaring birds do, to maintain a pendulous lateral equilibrium, and he employed that device. He anticipated by sixty years the Frenchman, Pénaud,



THE OFFENBURG-FREIBURG EXPRESS RACING WITH AND SNAPSHOTTED FROM THE ZEPPELIN AIR-SHIP "SCHWABEN."

Courtesy of "The Illustrated London Times."

THE AIR-SHIP "ZEPPELIN III." FLYING OVER THE ELBE DURING A SEVERE THUNDERSTORM.

in providing for fore and aft equilibrium by setting the tail, or horizontal rudder, at a slightly negative angle, so that when the flier plunges too swiftly downward the increasing pressure on top of its tail causes the bow to rise until the speed and course of flight attain their natural uniformity. From the weight and observed rate of descent of his glider model he computed the work of gravity expended in its propulsion, and thence proceeded to estimate the power and weight of an artificial motor that should drive a dynamic aeroplane. Finding the cumbrous steam engine of his time inadequate, he conceived the idea of employing an internal combustion engine in its place, thus anticipating the modern aeronautical motor. Indeed, the contributions to the science of flight made by Sir George Cayley seem to be the most radical, fundamental and original of any that have been recorded up to the present time by the promoters of mechanical flight.

The English engineer, Samuel Henson, made the next substantial advance in the devices and principles of aviation. He had not the originality and scientific method of his illustrious predecessor, Cayley; but, as patent lawyers phrase it, he "reduced to practice" his remarkable conception of a dynamic aeroplane. In 1842, he patented a monoplane having all the mechanical features essential to successful flight. It was provided with a horizontal and a vertical rudder operable by the pilot to control the poise of the flier about corresponding axes, and was furnished with a vertical keel surface, placed above the center of gravity, to aid in steering and to lend inherent lateral stability, on the principle of the side planes in a box kite. Henson's monoplane was thus equipped as well for security of poise and control in flight as a practical modern aeroplane of the Voisin type. Its wings, which were of very efficient shape, were trussed and covered very much like those of a modern monoplane. The machine was to be propelled by an engine actuating twin screws, like the successful models of Tatin, Langley and others of later date; and was provided with a three-wheel chassis for starting and landing, as commonly practised nowadays by machines of the Curtiss type.

Thus, while Cayley first set forth the scientific principles of flight, Henson may be called the first practical inventor of the commercial aeroplane, in so far as he first disclosed and patented an invention capable of sustained flight with passengers. His system of control was the same in principle as that of the early Voisin machine in which Paulhan once flew 82 miles in gusty weather. For lack of suitable motive power, however, Henson wisely refrained from constructing a full-size machine.

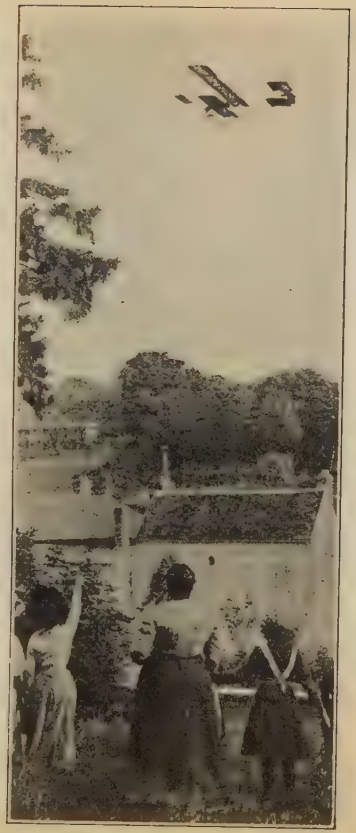
In 1846 Stringfellow, who had previously experimented with Henson, built a steam model aeroplane of about the size of a large soaring bird, and weighing altogether, with fuel and water, 6½ pounds. A special feature of this model was that its main surfaces were sloped like the wings of a bird, slightly concave below and feathered toward the back; thus making it more efficient and stable in flight. With a good head of steam, and propellers whirling, the model ran down a stretched wire, leaped into the air "and darted off in as fair a flight as it was possible to make, to a distance of about 40 yards." This was the first power-driven aeroplane model to fly successfully and balance itself in the air.

In 1868 another Englishman distinguished in aviation science, Mr. F. H. Wenham, published a paper setting forth the aerodynamic advantages of driving aeroplanes long edge first, to increase their lift, and of placing several surfaces one above the other to secure ample support with moderate wing spread. He may thus be regarded as the first inventor of a biplane or multiplane. He reduced to practice these ideas by patenting a multiple surface aeroplane, and making a tentative glider on which the pilot should lie prone in flight.

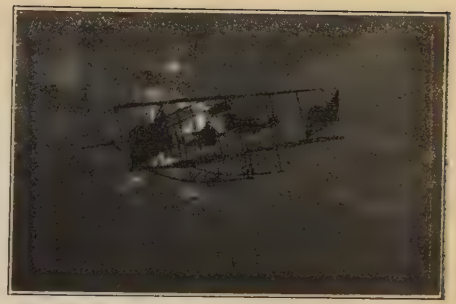
Profiting by this new principle of construction and support, Stringfellow in 1868 built a triplane model propelled by twin screws actuated by a high pressure steam engine contained in a double-wedge shaped car, which car moreover served as a steadying keel. The sustaining part of this machine comprised three superposed parallel planes held rigidly in place by vertical posts and oblique tie wires. He was thus first to use the Pratt truss arrangement common to the biplanes and multiplanes of the present day. The little model flew in the Crystal Palace, London, but with in-

CURTISS MILITARY HYDRO-AEROPLANE.

CURTISS BIPLANE.



FARMAN FLYING OVER MÉZIÈRES.

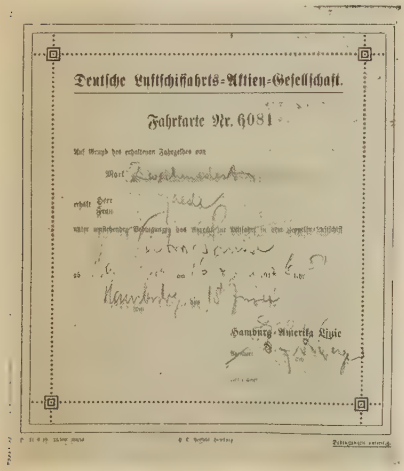


BOLAND BIPLANE.

ROBINSON IN CURTISS HYDRO-AEROPLANE.

different success. It now hangs from the ceiling of the American Museum at Washington, along with other historical model fliers.

In 1884, Horatio Phillips, of England, who had tested a great variety of model wing forms in a wind-tunnel, patented a shape very like the wing of a good modern aeroplane. He was the first to show the world quantitatively, by published researches and by actual use in experimental aeroplanes, the superior merits of arched surfaces, both single and superposed. Phillips' wing-shape has been adopted with various modifications in many notable aeroplanes of recent years. Investigations leading to similar results were conducted in Germany, by Otto Lilienthal and his brother. Their results were published in the succeeding decade, and amply tested in several man-carrying gliding machines, both monoplanes and biplanes, with which many hundred successful glides down hill slopes were made. Finally Octave Chanute, the distinguished American railway and bridge engineer, aided by Mr. A. M. Herring, perfected the two-surface glider, and developed the finished type of structure now commonly known as the Chanute biplane. A particular feature of the original Chanute glider for securing inherent lateral stability were the vertical side planes,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first used by Lawrence Hargrave, inventor of the box kite.

The now very commonly used system of controlling the poise of an aeroplane in flight was invented and disclosed many times before the advent of practical flying. In 1868 Matthew Boulton of England first gave to the world a system of control comprising a vertical rudder, a horizontal rudder, and a pair of reverse turning ailerons operable by hand or automatically. He was therefore the original inventor of the three-torque, or three-rudder, system in aviation. In 1893 the system of torsional wings together with vertical and horizontal rudders for controlling flight was publicly described by the present writer * in America and by Felix Ader in France, who embodied it in his monoplane. This system was practically employed, in one form or another, by the Wright brothers and by Prof. Montgomery, early in the twentieth century. The first public demonstration of the system was made by Montgomery as early as April, 1905. In 1899 Hugo Mattullath, of New York, drew up patent specifications, later allowed by the U. S. Patent Office, for a hydroaeroplane with two floats and a control system comprising a vertical rudder and aileron-like surfaces on either side of his machine fore and aft. The common aileron system seems to have been first practically used and indeed reinvented early in 1908, by the Aerial Experiment Association, at Hammondsport, N. Y.

As to the first human power flights, Ader in 1890 is reported to have flown 150 feet in a wheel-mounted monoplane driven by a steam engine actuating twin screws, and controlled in flight by independently operable horizontal and vertical rudders and reversely warpable wing tips. The construction of his machine is well known, but its flights are not well authenticated. Maxim three years later rose from a track in a steam driven multiplane, the largest yet built, weighing 3.5 tons and lifting more than a ton of extra load. It had horizontal and vertical rudders, but no torsional wings and, because of its low center of

*The writer also applied the system in the winter of 1903, to the design, for the American Transit Co., of a wheel mounted aeroplane with streamline body enclosing the aviator and having transparent walls.

gravity, it was too unsteady for practical flight. Owing to their excessive waste of fuel and water, both the Ader and the Maxim power plants were unsuitable for long voyages in the air.

The first dynamic aeroplane of adequate stability and power to carry a man in prolonged flight was that of Dr. Langley, completed in 1903. The famous secretary of the Smithsonian Institution and his assistant, Charles M. Manley, by designing and constructing a suitable motor, surmounted the last formidable, the hardest, the centuries old obstacle in the development of an aeroplane adapted to human flight. This was a gasoline engine of fifty-two brake horse power weighing two hundred pounds and competent to run for many hours under full load. Moreover they had provided for both inherent stability and effective manipulation of the machine in flight. The pilot could control the poise and course by several devices; he could shift his weight some feet in either direction; he could elevate and depress the rear double rudder, which when untouched insured steady longitudinal poise on the principle introduced by Pénaud; he could steer to right and left by turning about its vertical axis a wind-vane rudder below and rearward of the boat. The wings were set at a dihedral angle, the lines of lift, propeller thrust and forward resistance passed through the centroid, or near it, thus providing for projectile and gravitational stability.

This machine was nearly a duplicate, on a four-fold scale, of the gasoline driven model which during the same year had flown many times with good inherent equilibrium, and this model in turn closely resembled in aerodynamic features the steam-driven model which flew and balanced itself successfully above the Potomac river in 1896. Naturally therefore, it was expected that, with a pilot on its back, the large machine would fly even more securely than its miniature prototype. Unfortunately this elaborately perfected monoplane met with an accident in launching, thereby bringing upon its inventor unmerited censure, and depriving him of the credit of having produced the first successful passenger aeroplane. But it is now understood by aeronautical engineers that his large machine, as well as the model, had all the elements essential to prolonged flight with good inherent stability, and with sufficient manual control for practical service in moderate weather. Moreover Bleriot, in a tandem monoplane closely patterned after Langley's, made a successful flight in 1907.

Langley's culminating labors in aviation, though apparently thwarted in the hour of imminent triumph, left his colleagues in both hemispheres undaunted and optimistic. A score of sanguine experimentalists were now at work in either hemisphere. Archdeacon in France had offered a prize of 3,000 francs for the first person to fly publicly 25 meters, with a maximum descent not exceeding one-third of the range. Bleriot, Santos-Dumont, Voisin, Ferber, Levavasseur, Esnault-Pelterie, Phillips, Cody, Ellhamer, abroad, the Wrights, Berliner, Graham Bell, Montgomery in this country, and many others who eventually built successful aeroplanes, were now pursuing aviation with unwavering confidence. The Wrights, in this country, and Phillips abroad were the first to achieve a measure of success; the former in December, 1903, when one of them flew for fifty-nine seconds in a wheelless biplane driven by a gasoline motor; the latter in 1904, when he flew across a field in a wheel-mounted gasoline-driven multiplane. But these were private flights of no avail to the profession generally, except that the report of the Wright experiments stimulated others to increased activity which soon led to success in several localities, while the Wrights were still concealing their apparatus. The first flights made before the technical public were, in Europe, those of Santos-Dumont and Ellhamer, in America, those of the Aerial Experiment Association at Hammondsport, New York. The latter was the first to demonstrate before technical men the merits of the three-rudder system of control on a dynamic aeroplane. Henceforward the art advanced with prodigious strides, under the munificent patronage of a marveling and delighted public.

Among the recent improvements employed in present-day aeroplanes are the wheeled-landing skids, the various automatic stabilizing surfaces and the aquatic appliances. Landing skids were familiar in the art during the last decade of the nineteenth century, and skids combined with wheels, to which they were elastically attached, were introduced by Henri Farman in

1909. Among the automatic stabilizing surfaces may be noted, in addition to the rigid dorsal fin first patented by Henson, the elastic rearward protruding wing-tips and the elastic tail introduced by the Austrian engineer, Etrich, and the pendulum-operated controlling surfaces devised and tried by various experimentalists, but not yet generally adopted. The aquatic devices proposed many years ago, and first practically employed by Curtiss in America, which enable an aeroplane to rise from the water and land thereon, constitute perhaps the most radical modern improvement in aviation, virtually adding a new and very important domain to the empire of dynamic flight.

Following the successful inauguration of the flying-machine for sportive and military uses, special types of aeroplanes were rapidly developed for the attainment of special ends. Machines of stream-line form with powerful motors, and limited wing surface, were used to attain high speed, as the Nieuport, Deperdussin, Esnault-Pelterie, etc.; machines of large wing surface and great power were used to carry large burdens, etc. Without presenting the details of construction, the following tables exhibit the marvelous progress of the art as told by the records of well attested flights.

THE $2,400 SCIENTIFIC AMERICAN TROPHY WON BY GLENN H. CURTISS. (Page 456.)

AMERICAN AVIATION RECORDS (IN CLOSED CIRCUIT, WITHOUT STOPS).

A.—SPEED.

1.—Time on a Given Distance

(a) Aviator Alone

Distance Kilom.	Distance Miles	Holder	Place	Date	Machine	Motor	Time
5	3.107	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	2′ 44 4-5″
10	6.214	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	5′ 30 9-10″
20	12.427	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	11′ 04 4-5″
30	18.641	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	16′ 38 3-5″
40	24.855	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	22′ 12 3-5″
50	31.068	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	27′ 48 7-10″
100	62.137	C. Grahame-White	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	1 hr. 00′ 41 7-10″
150	93.205	St. C. Johnstone	Mineola, N. Y.	July 27, 1911	Moisant (Blériot-type)	50 h.p. Gnôme	2 hrs. 08′ 01 1-5″
200	124.274	St. C. Johnstone	Mineola, N. Y.	July 27, 1911	Moisant (Blériot-type)	50 h.p. Gnôme	2 hrs. 49′ 52 1-5″
250	155.342	St. C. Johnstone	Mineola, N. Y.	July 27, 1911	Moisant (Blériot-type)	50 h.p. Gnôme	3 hrs. 32′ 56 2-5″

(b) Aviator and One Passenger

10	6.214	C. Grahame-White	Nassau B'lev'd, N. Y.	Sept. 30, 1911	Nieuport	70 h.p. Gnôme	6′ 13 2-5″
20	12.427	C. Grahame-White	Nassau B'lev'd, N. Y.	Sept. 30, 1911	Nieuport	70 h.p. Gnôme	12′ 26 3-5″
30	18.641	C. Grahame-White	Nassau B'lev'd, N. Y.	Sept. 30, 1911	Nieuport	70 h.p. Gnôme	18′ 42″
40	24.855	C. Grahame-White	Nassau B'lev'd, N. Y.	Sept. 30, 1911	Nieuport	70 h.p. Gnôme	24′ 49 4-5″
50	31.068	C. Grahame-White	Nassau B'lev'd, N. Y.	Sept. 30, 1911	Nieuport	70 h.p. Gnôme	31′ 01 3-5″

(c) Aviator and Two Passengers

5	3.107	T. O. M. Sopwith	Chicago, Ill.	Aug. 15, 1911	Wright	30 h.p. Wright	6′ 56 2-5″

2.—Distance in a Given Time

(a) Aviator Alone

25	15.534	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	15′
50	31.068	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	30′
95	59.030	A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	1 hr.
		C. Grahame-White	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	1 hr.
141.97 •	88.216	St. C. Johnstone	Mineola, N. Y.	July 27, 1911	Moisant (Blériot-type)	50 h.p. Gnôme	2 hrs.

Distance Kilom.	Distance Miles	Holder	Place	Date	Machine	Motor	Time
214.57	133.327	St. C. Johnstone	Mineola, N. Y.	July 27, 1911	Moisant (Blériot-type)	50 h.p. Gnôme	3 hrs.
283.628	176.238	St. C. Johnstone	Mineola, N. Y.	July 27, 1911	Moisant (Blériot-type)	50 h.p. Gnôme	4 hrs.
			(b) Aviator and One Passenger				
24.14	15	C. Grahame-White	Squantum, Mass.	Sept. 4, 1911	Nieuport	70 h.p. Gnôme	15′
48.28	30	C. Grahame-White	Nassau B'lev'd, N. Y.	Sept.30, 1911	Nieuport	70 h.p. Gnôme	30′

3.—Greatest Speed Obtained, Whatever the Length of the Flight

(a) Aviator Alone

Holder	Place	Date	Machine	Motor	Speed per Hour Kilom.	Speed per Hour Miles
A. Leblanc	Belmont Park, N. Y.	Oct. 29, 1910	Blériot	100 h.p. Gnôme	109.237	67.877
		(b) Aviator and One Passenger				
C. Grahame-White	Squantum, Mass.	Sept. 4, 1911	Nieuport	70 h.p. Gnôme	101.762	63.232
		(c) Aviator and Two Passengers				
T. O. M. Sopwith	Chicago, Ill.	Aug. 15, 1911	Wright	30 h.p. Wright	56.263	34.96

B.—GREATEST DISTANCE

Aviator Alone

Holder	Place	Date	Machine	Motor	Distance Covered Kilom.	Distance Covered Miles
St. C. Johnstone	Mineola, N. Y.	July 27, 1911	Moisant (Blériot-type)	50 h.p. Gnôme	283.628	176.238

C.—GREATEST DURATION

(a) Aviator Alone

Holder	Place	Date	Machine	Motor	Duration of Flight
H. W. Gill	Kinloch, Mo.	Oct. 19, 1911	Wright	30 h.p. Wright	4 hrs. 16′ 35″
		(b) Aviator and One Passenger			
G. W. Beatty	Chicago, Ill.	Aug. 19, 1911	Wright	30 h.p. Wright	3 hrs. 42′ 22 1-5″
		(c) Aviator and Two Passengers			
T. de W. Milling	Nassau B'lev'd, N.Y.	Sept.26, 1911	Burgess-Wright	30 h.p. Wright	1 hr. 54′ 42 3-5″

D.—ALTITUDE

1.—Greatest Altitude

(a) Aviator Alone

Holder	Place	Date	Machine	Motor	Altitude Attained Meters	Altitude Attained Feet
L. Beachy	Chicago, Ill.	Aug. 20, 1911	Curtiss	75 h.p. Curtiss	3,548½	11,642
		(b) Aviator and One Passenger				
C. Grahame-White	Nassau B'lev'd, N.Y.	Sept.30, 1911	Nieuport	70 h.p. Gnôme	1,020	3,347

AMERICAN AVIATION RECORDS—Continued.

2.—Climbing (Upward Vertical Speed)

(a) Aviator Alone

					Altitude Meters	Time
R. Simon	Chicago, Ill.	Aug. 19, 1911	Blériot	50 h.p. Gnôme	500 (1,640 ft.)	*3′ 35″
T. O. M. Sopwith	Chicago, Ill.	Aug. 19, 1911	Blériot	70 h.p. Gnôme		

(b) Aviator and One Passenger

C. Grahame-White	Nassau B'lev'd, N.Y.	Sept. 30, 1911	Nieuport	70 h.p. Gnôme	1,000 (3.280 ft.)	*9′

E.—ALIGHTING

Aviator Alone

					Distance from Mark
T. O. M. Sopwith	Nassau B'lev'd, N.Y.	July 22, 1911	Howard Wright (Farman-type)	60 h.p. E. N. V.	1ft. 5½in. (0.445 meter)

F.—WEIGHT-CARRYING

					Weight
P. O. Parmelee	Chicago, Ill.	Aug. 19, 1911	Wright	30 h.p. Wright	458 lbs. (207¾ kilog.)

*World's Records.

WORLD'S FLYING RECORDS (IN CLOSED CIRCUIT, WITHOUT STOPS.)

A.—SPEED

1.—Time on a Given Distance

(a) Aviator Alone

Distance Kilom.	Distance Miles	Holder	Place	Date	Machine	Motor	Time
5	3.107	J. Védrines	Pau, France	Jan. 13, 1912	Deperdussin mono	100 h.p. Gnôme	2′ 06 2-5″
10	6.214	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	3′ 35 4-5″
20	12.427	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	7′ 14″
30	18.641	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	10′ 53 4-5″
40	24.855	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	14′ 32 1-5″
50	31.068	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	18′ 10 2-5″
100	62.137	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	36′ 23 1-5″
150	93.205	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	54′ 37 3-5″
200	124.274	J. Védrines	Pau, France	Feb. 22, 1912	Deperdussin mono	140 h.p. Gnôme	1h. 15′ 20 4-5″
250	155.342	M. Tabuteau	Pau, France	Jan. 24, 1912	Morane-Saulnier mono	50 h.p. Gnôme	2h. 22′ 57 3-5″
300	186.411	M. Tabuteau	Pau, France	Jan. 24, 1912	Morane-Saulnier mono	50 h.p. Gnôme	2h. 51′ 43 4-5″
350	217.479	P. M. Bournique	Buc, France	Dec. 31, 1910	R. E. P. mono	45 h.p. R. E. P.	4h. 17′ 26 1-5″
400	248.548	P. M. Bournique	Buc, France	Dec. 31, 1910	R. E. P. mono	45 h.p. R. E. P.	4h. 54′ 06 4-5″
450	279.616	P. M. Bournique	Buc, France	Dec. 31, 1910	R. E. P. mono	45 h.p. R. E. P.	5h. 30′ 35 3-5″
500	310.685	P. M. Bournique	Buc, France	Dec. 31, 1910	R. E. P. mono	45 h.p. R. E. P.	6h. 07′ 07 4-5″
600	372.822	G. Fourny	Buc, France	Sept. 1, 1911	M. Farman bi	60 h.p. Renault	9h. 16′ 27 3-5″
700	434.959	G. Fourny	Buc, France	Sept. 1, 1911	M. Farman bi	60 h.p. Renault	10h. 43′ 46 1-5″

(b) Aviator and One Passenger

Distance Kilom.	Distance Miles	Holder	Place	Date	Machine	Motor	Time
5	3.107	Lieut. H. Bier	W.-Neustadt	Oct. 1, 1911	Etrich mono	50 h.p. Gnôme	2′ 58″
10	6.214	E. Nieuport	Mourmelon	Mar. 6, 1912	Nieuport mono	50 h.p. Gnôme	5′ 58 1-5″
20	12.427	E. Nieuport	Mourmelon	Mar. 6, 1912	Nieuport mono	50 h.p. Gnôme	11′ 54 3-5″
30	18.641	E. Nieuport	Mourmelon	Mar. 6, 1912	Nieuport mono	50 h.p. Gnôme	17′ 53 1-5″
40	24.855	E. Nieuport	Mourmelon	Mar. 6, 1912	Nieuport mono	50 h.p. Gnôme	23′ 57 3-5″
50	31.068	E. Nieuport	Mourmelon	Mar. 6, 1912	Nieuport mono	50 h.p. Gnôme	29′ 58 3-5″
100	62.137	E. Nieuport	Mourmelon	Mar. 6, 1912	Nieuport mono	50 h.p. Gnôme	59′ 16″
150	93.205	E. Nieuport	Mourmelon	Mar. 6, 1912	Nieuport mono	50 h.p. Gnôme	1h. 28′ 37 4-5″
200	124.274	Lieut. H. Bier	W.-Neustadt	Oct. 1, 1911	Etrich mono	100 h.p. Daimler	2h. 03′ 49″
250	155.342	Lieut. H. Bier	W.-Neustadt	Oct. 1, 1911	Etrich mono	100 h.p. Daimler	2h. 39′ 37″

(c) Aviator and Two Passengers

10	6.214	E. Nieuport	Mourmelon	Mar. 9, 1911	Nieuport mono	50 h.p. Gnôme	6′
20	12.427	E. Nieuport	Mourmelon	Mar. 9, 1911	Nieuport mono	50 h.p. Daimler	11′ 59 2-5″
30	18.641	E. Nieuport	Mourmelon	Mar. 9, 1911	Nieuport mono	50 h.p. Daimler	17′ 52 3-5″
40	24.855	E. Nieuport	Mourmelon	Mar. 9, 1911	Nieuport mono	50 h.p. Daimler	22′ 44 2-5″
50	31.068	E. Nieuport	Mourmelon	Mar. 9, 1911	Nieuport mono	50 h.p. Daimler	29′ 37 2-5″
100	62.137	E. Nieuport	Mourmelon	Mar. 9, 1911	Nieuport mono	50 h.p. Daimler	59′ 08″

(d) Aviator and Three Passengers

10	6.214	G. Busson	Rheims	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	6′ 16 3-5″
20	12.427	G. Busson	Rheims	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	12′ 34 1-5″
30	18.641	G. Busson	Rheims	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	18′ 48″
40	24.855	G. Busson	Rheims	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	25′ 05 3-5″
50	31.068	G. Busson	Rheims	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	31′ 23 1-5″

(e) Aviator and Four Passengers

5	3.107	G. Busson	Rheims	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	3′ 34″
10	6.214	G. Busson	Rheims	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	7′ 08″
20	12.427	G. Busson	Rheims	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	14′ 00 3-5″

COLLEGE COLORS.

Amherst College.....Purple and White.
Brown University.....Brown and White.
Carlisle Indian School..Red and Old Gold.
College City N. Y....Lavender and Black.
Columbia University... Light Blue and White.
Cornell University.....Carnelian and White.
Dartmouth College.....Dark Green.
Fordham University....Maroon.
Harvard University... Crimson.
Johns Hopkins Univ... Black and Old Gold.
New York University..Violet.
Princeton University...Orange and Black.
Rensselaer Poly. Inst..Cherry and White.
Rutgers College..... Scarlet.
Syracuse University....Orange.
Univ. of California....Blue and Gold.
Univ. of Chicago.....Maroon.
Univ. of Michigan....Maize and Azure.
Univ. of Pennsylvania..Red and Blue.
Univ. of Rochester....Yellow.
U. S. Military Acad... Black, Gold and Gray.
U. S. Naval Academy..Blue and Gold.
Williams College.....Royal Purple.
Yale University.....Blue.

WORLD'S FLYING RECORDS—Continued.

2.—Distance in a Given Time

(a) Aviator Alone

Distance Kilom.	Distance Miles	Holder	Place	Date	Machine	Motor	Time
40.374	25.087	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	15′
80.374	49.942	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	30′
164.331	102.11	J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	1 hr.
227.454	141.333	M. Tabuteau	Pau, France	Feb. 23, 1912	Morane-Saulnier mono	50 h.p. Gnôme	2 hrs.
310.287	192.803	M. Tabuteau	Pau, France	Jan. 24, 1912	Morane-Saulnier mono	50 h.p. Gnôme	3 hrs.
325.905	202.508	P. M. Bournique	Buc, France	Dec. 31, 1910	R. E. P. mono	45 h.p. R. E. P.	4 hrs.
407.675	253.317	P. M. Bournique	Buc, France	Dec. 31, 1910	R. E. P. mono	45 h.p. R. E. P.	5 hrs.
490.	304.471	P. M. Bournique	Buc, France	Dec. 31, 1910	R. E. P. mono	45 h.p. R. E. P.	6 hrs.
522.935	324.936	M. Tabuteau	Buc, France	Dec. 30, 1910	M. Farman bi	60 h.p. Renault	7 hrs.
510.	316.899	G. Fourny	Buc, France	Sept. 1, 1911	M. Farman bi	60 h.p. Renault	8 hrs.
580.	360.395	G. Fourny	Buc, France	Sept. 1, 1911	M. Farman bi	60 h.p. Renault	9 hrs.
650.	403.89	G. Fourny	Buc, France	Sept. 1, 1911	M. Farman bi	60 h.p. Renault	10 hrs.
710.	441.173	G. Fourny	Buc, France	Sept. 1, 1911	M. Farman bi	60 h.p. Renault	11 hrs.

(b) Aviator and One Passenger

24.805	16.413	Lieut. H. Bier	W.-Neustadt	Oct. 1, 1911	Etrich mono	100 h.p. Daimler	15′
50.	31.068	E. Nieuport	Mourmelon	Mar. 6, 1911	Nieuport mono	50 h.p. Gnôme	30′
101.25	62.914	E. Nieuport	Mourmelon	Mar. 6, 1911	Nieuport mono	50 h.p. Gnôme	1 hr.
190.858	118.593	Lieut. H. Bier	W.-Neustadt	Oct. 1. 1911	Etrich mono	100 h.p. Daimler	2 hrs.
224.85	139.715	R. Level	Chartres	July 30, 1911	Savary bi	60 h.p. Labor-Aviation	3 hrs.

3.—Greatest Speed, Whatever the Length of the Flight

(a) Aviator Alone

Holder	Place	Date	Machine	Motor	Speed per Hour Kilom.	Speed per Hour Miles
J. Védrines	Pau, France	Mar. 1, 1912	Deperdussin mono	140 h.p. Gnôme	166.821	103.769

(b) Aviator and One Passenger

E. Nieuport	Mourmelon, France	Mar. 6, 1911	Nieuport mono	50 h.p. Gnôme	103.211	64.132

(c) Aviator and Two Passengers

E. Nieuport	Mourmelon, France	Mar. 9, 1911	Nieuport mono	50 h.p. Gnôme	102.855	63.911

(d) Aviator and Three Passengers

G. Busson	Rheims, France	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	96.308	59.843

(e) Aviator and Four Passengers

G. Busson	Rheims, France	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	87.251	54.215

B.—GREATEST DISTANCE

(a) Aviator Alone

Holder	Place	Date	Machine	Motor	Distance Kilom.	Covered Miles
A. Gobé	Pau, France	Dec. 24, 1911	Nieuport mono	50 h.p. Gnôme	740.299	460.

(b) Aviator and One Passenger

Lieut. H. B. Barrington-Kennett	Salisbury Plain, Eng.	Feb. 14, 1912	Nieuport mono	70 h.p. Gnôme	401.495	249.477

(c) Aviator and Two Passengers

Lieut. H. Bier	Wiener-Neustadt, Austria	Oct. 4, 1911	Etrich mono	100 h.p. Daimler	112.	69.593

(d) Aviator and Three Passengers

G. Busson	Rheims, Betheny, France	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	50.	31.068

(e) Aviator and Four Passengers

G. Busson	Rheims, Betheny, France	Mar. 10, 1911	Deperdussin mono	100 h.p. Gnôme	25.74	15.994

C.—GREATEST DURATION

(a) Aviator Alone

Holder	Place	Date	Machine	Motor	Duration of Flight
G. Fourny	Buc, France	Sept. 1. 1911	M. Farman bi	60 h.p. Renault	11 hrs. 1′ 29 1-5″

(b) Aviator and One Passenger

J. Suvelack	Johannisthal, Germany	Dec. 8, 1911	Rumpler-Etrich mono	50 h.p. Rumpler	4 hrs. 34′

(c) Aviator and Two Passengers

J. Pietschker	Johannisthal, Germany	Oct. 1, 1911	Albatros bi	100 h.p. Argus	2 hrs. 19′

(d) Aviator and Three Passengers

K. Grülich	Johannisthal, Germany	Jan. 25, 1912	Harlan mono	100 h.p. Argus	1 hr. 35′

(f) Aviator and Five Passengers

H. Molla	Douzy, Fance	Jan. 26, 1912	Sommer bi	70 h.p. Gnôme	1 hr. 05′ 48 1-5″

THE CARNEGIE INSTITUTION.

This institution was founded by Mr. Andrew Carnegie for the promotion of original research in science, literature and art. He set aside $10,100,000 for the purpose. The interest is used to conduct, endow and assist investigation in any department of science, literature, or art, and to this end co-operate with governments, universities, colleges, technical schools, learned societies, and individuals. The headquarters of the institution are in Washington. Mr. R. S. Woodward is the President, and Mr. C. H. Dodge is the Secretary. Many grants have already been made, and the investigations have been important.

WORLD'S FLYING RECORDS—Continued.

D.—ALTITUDE

1.—Greatest Altitude

(a) Aviator Alone

Holder	Place	Date	Machine	Motor	Altitude Attained Meters	Feet
R. Garros	Paramé, France	Sept. 4, 1911	Blériot mono	50 h.p. Gnôme	3,910	12,828

(b) Aviator and One Passenger

M. Prévost	Courcy, France	Dec. 2, 1911	Deperdussin mono	100 h.p. Gnôme	2,700	8,858

(c) Aviator and Two Passengers

M. Prévost	Rheims, Betheny, France	Jan. 22, 1912	Deperdussin mono	100 h.p. Gnôme	2,000	6,562

2.—Climbing (Upward Vertical Speed)

(a) Aviator Alone

					Altitude Meters	Time
R. Simon	Chicago, U. S. A.	Aug. 19, 1911	Blériot mono	50 h.p. Gnôme	500 (1,640 ft.)	3′ 35″
T. O. Sopwith	Chicago, U. S. A.	Aug. 19, 1911	Blériot mono	70 h.p. Gnôme		

(b) Aviator and One Passenger

C. Grahame-White	Nassau Boulevard, U. S. A.	Sept. 30, 1911	Nieuport mono	70 h.p. Gnôme	1,000 (3,280 ft.)	9′

THE AMERICAN MUSEUM OF SAFETY.

The American Museum of Safety, the twelfth institution of its kind in the world and the first in the United States, had its inception in two special expositions of safety in New York City—the first in 1907, lasting two weeks, and the second, in 1908, lasting two months. These beginnings led to the formal organization of the American Museum of Safety, which now holds a special charter of incorporation granted by the Assembly and Senate of the State of New York.

According to the Museum's special charter, the purpose of the institution is given as follows: "The objects of the corporation hereby created are to study and promote means and methods of safety and sanitation and the application thereof to any and all public and private occupations whatsoever, and of advancing knowledge of kindred subjects; and to that end to establish and maintain a museum, library and laboratories, and their branches, wherein all matters, methods and means for improving the general condition of the people as to their safety and health may be studied, tested and promoted, with a view to lessening the number of casualties and avoiding the causes of physical suffering and of premature death; and to disseminate the results of such study, researches, and tests by lectures, exhibitions and publications."

The American Museum of Safety is absolutely non-commercial. No orders are taken, no exhibits are sold, and no charge is made for space. Many of the devices are patented but may be practical, home-made appliances evolved in the experience and practice of the individuals or firms exhibiting them. No exhibits are accepted unless they have decided safety features.

With a view to stimulating the invention and introduction of safety devices in all the industries, and the promotion of hygiene and sanitation, three Gold Medals are annually awarded by the American Museum of Safety. The Travelers Insurance Company's Medal, the Louis Livingston Seaman Medal and The Scientific American Medal. The "Rathenau" German Medal has just been added.

The Scientific American Medal has been awarded three times. First, for a device for detecting fires at sea in holds, coal bunkers, etc. Second, for a safety scaffold that has practically eliminated hazard in this line of the building trades. Third, for a device for protecting workers on abrasive wheels. Such accidents are extremely dangerous and when we consider that there are over one million of these wheels in the United States, the number of risks becomes apparent.

COMPARATIVE TABLE OF PROGRESSION OF AMERICAN AND EUROPEAN DURATION RECORDS.

PROGRESSION OF AMERICAN DURATION RECORD.

Date	Time	Aviator	Machine	Place
Dec. 17, 1903	59″	W. Wright	Wright bi	Kitty Hawk, N. C.
Aug. 1904	About 1′	W. Wright	Wright bi	near Dayton, Ohio
Sept. 15, 1904	1st turn	O. Wright	Wright bi	near Dayton, Ohio
Sept. 20, 1904	1st circle	O. Wright	Wright bi	near Dayton, Ohio
Nov. 9, 1904	5′ 04″	W. Wright	Wright bi	near Dayton, Ohio
Sept. 1905	5′ to 15′	W. Wright	Wright bi	near Dayton, Ohio
Sept. 26, 1905	18′ 09″	W. Wright	Wright bi	near Dayton, Ohio
Sept. 29, 1905	19′ 55″	O. Wright	Wright bi	near Dayton, Ohio
Oct. 3, 1905	25′ 05″	O. Wright	Wright bi	near Dayton, Ohio
Oct. 4, 1905	33′ 17″	O. Wright	Wright bi	near Dayton, Ohio
Oct. 5, 1905	38′ 03″	W. Wright	Wright bi	near Dayton, Ohio
Sept. 9, 1908	57′ 31″	O. Wright	Wright bi	Fort Myer, Va.
Sept. 9, 1908	1 hr. 02′ 15″	O. Wright	Wright bi	Fort Myer, Va.
Sept. 10, 1908	1 hr. 05′ 52″	O. Wright	Wright bi	Fort Myer, Va.
Sept. 11, 1908	1 hr. 10′ 24″	O. Wright	Wright bi	Fort Myer, Va.
Sept. 12, 1908	1 hr. 14′ 20″	O. Wright	Wright bi	Fort Myer, Va.
July 20, 1909	1 hr. 20′ 45″	O. Wright	Wright bi	Fort Myer, Va.
Jan. 17, 1910	1 hr. 58′ 32″	L. Paulhan	H. Farman bi	Los Angeles, Cal.
July 2, 1910	2 hrs. 03′ 30″	C. B. Harmon	H. Farman bi	Mineola, N. Y.
Sept. 12, 1910	3 hrs. 05′ 40″	R. Johnstone	Wright bi	Boston, Mass.
Oct. 11, 1910	3 hrs. 11′ 55″	A. L. Welsh	Wright bi	St. Louis, Mo.
Dec. 30, 1910	3 hrs. 16′ 50″	A. Hoxsey	Wright bi	Los Angeles, Cal.
Jan. 22, 1911	3 hrs. 38′ 49″	P. O. Parmelee	Wright bi	San Francisco, Cal.
July 27, 1911	4 hrs. 1′ 52″	St. Croix Johnstone	Blériot mono	Mineola, N. Y.
Oct. 19, 1911	4 hrs. 16′ 35″	H. W. Gill	Wright bi	Kinloch, Mo.

FAMOUS WATERFALLS OF THE WORLD.

Name and Location.	Height in feet.
Grand, Labrador	2,000
Sutherland, New Zealand	1,904
Yosemite (upper), Cal.	1,436
Gavarnie, France	1,385
Takkakaw, Brit. Col	1,200
Staubbach, Switzerland	1,000
Vettis, Norway	950
Multnomah, Oregon	850
Rjukan, Norway	780
Yosemite (middle), Cal.	626
Voringfos, Norway	600
Skajaeggedalsfos, Norway	530
Stirling, New Zealand	500
Yosemite (lower), Cal.	490
Victoria, Africa	400
Yellowstone (lower), Mont.	310
Montmorenci, Quebec	265
Shoshone, Idaho	210
Ygnassu, Brazil	210
Twin, Idaho	180
Niagara, New York-Ontario	164
Yellowstone (upper), Montana	110
Murchison, Africa	120
Schaffhausen, Switzerland	100
Missouri, Montana	90
Minnehaha, Minnesota	50

PROGRESSION OF EUROPEAN DURATION RECORD.

Date	*Time*	*Aviator*	*Machine*	*Place*
Nov. 12, 1906	21 1-5″	A. Santos-Dumont	Santos-Dumont bi.	Bagatelle, near Paris
Oct. 26, 1907	27″	H. Farman	Voisin bi	Issy-les-Moulineaux, France
Oct. 26, 1907	31 3-5″	H. Farman	Voisin bi	Issy-les-Moulineaux, France
Oct. 26, 1907	52 3-5″	H. Farman	Voisin bi	Issy-les-Moulineaux, France
Nov. 9, 1907	1st turn 1′ 14″	H. Farman	Voisin bi	Issy-les-Moulineaux, France
Jan. 13, 1908	1′ 28″	H. Farman	Voisin bi	Issy-les-Moulineaux, France
Jan. 13, 1908	1′ 33″	H. Farman	Voisin bi	Issy-les-Moulineaux, France
Mar. 21, 1908	1st circle 3′ 39″	H. Farman	Voisin bi	Issy-les-Moulineaux, France
Apr. 11, 1908	6′ 30″	L. Delagrange	Voisin bi	Issy-les-Moulineaux, France
May 27, 1908	9′ 30″	L. Delagrange	Voisin bi	Rome, Italy
May 30, 1908	15′ 26 4-5″	L. Delagrange	Voisin bi	Rome, Italy
June 22, 1908	16′ 30″	L. Delagrange	Voisin bi	Milan, Italy
July 6, 1908	20′ 19 3-5″	H. Farman	Voisin bi	Issy-les-Moulineaux, France
Sept. 6, 1908	29′ 53 3-5″	L. Delagrange	Voisin bi	Issy-les-Moulineaux, France
Sept. 16, 1908	39′ 18 3-5″	W. Wright	Wright bi	near Le Mans, France
Sept. 21, 1908	1 hr. 31′ 25 4-5″	W. Wright	Wright bi	near Le Mans, France
Dec. 18, 1908	1 hr. 54′ 53 2-5″	W. Wright	Wright bi	near Le Mans, France
Dec. 31, 1908	2 hrs. 20′ 23 1-5″	W. Wright	Wright bi	near Le Mans, France
Aug. 7, 1909	2 hrs. 27′ 15″	R. Sommer	Sommer bi	Mourmelon, France
Aug. 25, 1909	2 hrs. 43′ 24 4-5″	L. Paulhan	H. Farman bi	near Rheims, France
Aug. 27, 1909	3 hrs. 15′	H. Farman	H. Farman bi	near Rheims, France
Nov. 3, 1909	4 hrs. 17′ 53 2-5″	H. Farman	H. Farman bi	Mourmelon, France
July 9, 1910	4 hrs. 37′ 00 2-5″	R. Labouchere	Blériot mono	near Rheims, France
July 10, 1910	5 hrs. 03′ 05 1-5″	J. Olieslaegers	Blériot mono	near Rheims, France
Oct. 28, 1910	6 hrs. 01′ 35″	M. Tabuteau	M. Farman bi	Buc, France
Dec. 18, 1910	8 hrs. 12′ 47 2-5″	H. Farman	H. Farman bi	Etampes, France
Sept. 1, 1911	11 hrs. 1′ 29 1-5″	G. Fourny	M. Farman bi	Buc, France

All records are from the Bulletin of the Aero Club of America, Reproduced by permission.

SCIENTIFIC AMERICAN TROPHY. (See page 447.)

The Scientific American Trophy, shown on page 447, was donated with the object of fostering the art of aerial navigation. The deed of gift by which it was transferred to keeping of the Aero Club of America called for annual competition by heavier-than-air machines, with the understanding that the conditions governing the contest were to be changed from time to time, so as to keep pace with the progress made in the art of flying. On July 4, 1908, Mr. Glenn H. Curtiss won the trophy for that year by flying for a distance of slightly more than a mile in his new bi-plane, the "June Bug." In 1909, Curtiss again won the cup by flying a distance of about 25 miles in a closed circuit. In 1910, Curtiss won the cup for the third and last time in connection with his great flight from Albany to New York, when he covered a straightaway distance from Albany to Poughkeepsie of 74¼ miles without a stop. Mr. Curtiss by winning three times secured permanent possession of the trophy.

PART II.

CHAPTER I.

CHEMISTRY.

EDITED BY WILLIAM W. SHARE, Ph.D.

INTERNATIONAL ATOMIC WEIGHTS FOR 1912.

Element.	Symbol.	O=16.	H=1.	Element.	Symbol.	O=16.	H=1.
Aluminium	Al	27.1	26.88	Molybdenum	Mo	96.0	95.2
Antimony	Sb	120.2	119.25	Neodymium	Nd	144.3	143.2
Argon	A	39.88	39.56	Neon	Ne	20.2	20.
Arsenic	As	74.96	74.37	Nickel	Ni	58.68	58.21
Barium	Ba	137.37	136.28	Niton	Nt	222.4	220.6
Bismuth	Bi	208.	206.35	Nitrogen	N	14.01	13.90
Boron	B	11.	10.91	Osmium	Os	190.9	189.4
Bromine	Br	79.92	79.29	Oxygen	O	16.	15.88
Cadmium	Cd	112.40	111.51	Palladium	Pd	106.7	105.8
Caesium	Cs	132.81	131.8	Phosphorus	P	31.04	30.79
Calcium	Ca	40.07	39.75	Platinum	Pt	195.2	194.64
Carbon	C	12.	11.91	Potassium	K	39.10	38.79
Cerium	Ce	140.25	139.1	Praseodymium	Pr	140.6	139.5
Chlorine	Cl	35.46	35.18	Radium	Ra	226.4	224.6
Chromium	Cr	52.	51.59	Rhodium	Rh	102.9	102.1
Cobalt	Co	58.97	58.5	Rubidium	Rb	85.45	84.8
Columbium	Cb	93.5	92.76	Ruthenium	Ru	101.7	100.9
Copper	Cu	63.57	63.06	Samarium	Sa	150.4	149.2
Dysprosium	Dy	162.5	161.2	Scandium	Sc	44.1	43.8
Erbium	Er	167.7	166.4	Selenium	Se	79.2	78.6
Europium	Eu	152.	151.1	Silicon	Si	28.3	28.08
Fluorine	F	19.	18.75	Silver	Ag	107.88	107.02
Gadolinium	Gd	157.3	156.1	Sodium	Na	23.	22.82
Gallium	Ga	69.9	69.3	Strontium	Sr	87.63	86.93
Germanium	Ge	72.5	71.9	Sulphur	S	32.07	31.82
Glucinum	Gl	9.1	9.	Tantalum	Ta	181.5	180.1
Gold	Au	197.2	195.6	Tellurium	Te	127.5	126.5
Helium	He	3.99	3.96	Terbium	Tb	159.2	157.9
Hydrogen	H	1.008	1.	Thallium	Tl	204.	202.4
Indium	In	114.8	113.9	Thorium	Th	232.4	230.6
Iodine	I	126.92	125.91	Thulium	Tm	168.5	167.2
Iridium	Ir	193.1	191.56	Tin	Sn	119.	118.06
Iron	Fe	55.84	55.4	Titanium	Ti	48.1	47.7
Krypton	Kr	82.92	82.2	Tungsten	W	184.	182.5
Lanthanum	La	139.	137.9	Uranium	U	238.5	236.6
Lead	Pb	207.1	205.46	Vanadium	V	51.	50.6
Lithium	Li	6.94	6.88	Xenon	Xe	130.2	129.2
Lutecium	Lu	174.	172.6	Ytterbium (Neo)	Yb	172.	170.6
Magnesium	Mg	24.32	24.13	Yttrium	Yt	89.	88.3
Manganese	Mn	54.93	54.49	Zinc	Zn	65.37	64.8
Mercury	Hg	200.6	199.01	Zirconium	Zr	90.6	89.95

THE ELEMENTS IN THE ORDER OF THEIR DISCOVERY.

Element.	Discoverer.	Date.	Element.	Discoverer.	Date.
Carbon	Prehistoric		Antimony	Valentine	1450
Copper	"		Bismuth	"	1450
Gold	"		Zinc	Paracelsus	1520
Silver	"		Phosphorus	Brandt	1669
Iron	"		Arsenic	Schroeder	1694
Sulphur	"		Cobalt	Brandt	1733
Mercury	"		Platinum	Wood	1741
Tin	"		Nickel	Cronstedt	1751
Lead	"		Hydrogen	Cavendish	1766

THE ELEMENTS IN THE ORDER OF THEIR DISCOVERY—Continued.

Element.	Discoverer.	Date.	Element.	Discoverer.	Date.
Fluorine	Scheele	1771	Thorium	Berzelius	1828
Nitrogen	Rutherford	1772	Yttrium	Woehler	1828
Chlorine	Scheele	1774	Magnesium	Bussy	1829
Manganese	Gahn	1774	Vanadium	Sefstroem	1830
Oxygen	Priestley	1774	Lanthanum	Mosander	1839
Tungsten	d'Elhujur	1781	Erbium	"	1843
Molybdenum	Hjelm	1782	Terbium	"	1843
Tellurium	Reichenstein	1782	Ruthenium	Claus	1845
Uranium	Klaproth	1789	Caesium	Bunsen	1860
Titanium	Gregor	1789	Rubidium	"	1860
Chromium	Vauquelin	1797	Thallium	Crookes	1862
Columbium	Hatchett	1801	Indium	Reich & Richter	1863
Tantalum	Ekeberg	1802	Gallium	Boisbaudran	1875
Cerium	Berzelius	1803	Ytterbium	Marignac	1878
Iridium	Tennant	1803	Samarium	Boisbaudran	1879
Osmium	"	1803	Scandium	Nilson	1879
Palladium	Wollaston	1804	Thulium	Cleve	1879
Rhodium	"	1804	Neodymium	Welsbach	1885
Sodium	Davy	1807	Praseodymium	"	1885
Potassium	"	1807	Gadolinium	Marignac	1886
Calcium	"	1808	Germanium	Winkler	1886
Barium	"	1808	Argon	Ramsay & Rayleigh	1894
Strontium	"	1808	Helium	Ramsay	1895
Boron	"	1808	Krypton	Ramsay & Travers	1898
Iodine	Courtois	1811	Neon	"	1898
Cadmium	Stromeyer	1817	Xenon	"	1898
Lithium	Arfvedson	1817	Radium	Curie	1898
Selenium	Berzelius	1817	Europium	Demarçay	1901
Silicon	"	1823	Dysprosium	Urbain	1906
Zirconium	"	1824	Lutecium	"	1907
Bromine	Balard	1826	Neoytterbium	"	1907
Aluminium	Woehler	1828	Niton	Ramsay & Gray	1910
Glucinum	"	1828			

MELTING POINTS OF SOME CHEMICAL ELEMENTS.

Substance.	Degrees Cent.	Degrees Fahr.	Substance.	Degrees Cent.	Degrees Fahr.
Aluminium	657	1215	Magnesium	632.6	1171
Antimony	630	1168	Manganese	1207	2205
Bismuth	269	516	Mercury	-38.85	-37.93
Cadmium	321.7	611	Nickel	1435	2615
Calcium	800	1472	Phosphorus	44.2	112
Chromium	1515	2759	Platinum	1753	3187
Cobalt	1464	2667	Potassium	63.6	146.5
Copper	1065	1949	Selenium	217	423
Gold	1060	1940	Silver	961.5	1763
Iridium	1950	3542	Sodium	97.6	208
Iron, pure	1505	2741	Sulphur	114.5	238
gray pig	1275	2327	Tantalum	2300	4172
white pig	1075	1967	Tin	232	550
Steel,	1360	2480	Titanium	3000	5432
cast	1375	2507	Tungsten	2800	5072
Lead	327	621	Vanadium	1680	3056
Lithium	180	356	Zinc	419	786

BOILING POINTS OF SOME CHEMICAL ELEMENTS.

Substance.	Degrees Cent.	Degrees Fahr.	Substance.	Degrees Cent.	Degrees Fahr.
Bromine	58.7	137.6	Oxygen	-182.5	-296.5
Cadmium	778	1400	Ozone	-119	-182.2
Chlorine	-33.6	-28.5	Phosphorus	290	554
Fluorine	-187	-304.6	Potassium	757.5	1396
Hydrogen	-252.5	-422.5	Selenium	690	1274
Iodine	185.5	366	Sodium	877.5	1612
Mercury	357.33	675.2	Sulphur	444.6	800
Nitrogen	-195.5	-320	Zinc	918	1684

THE MOST PLENTIFUL ELEMENTS AND THEIR PERCENTAGE DISTRIBUTION IN KNOWN MATTER.

Oxygen	47.98	Titanium	.30
Silicon	25.30	Carbon	.21
Aluminium	7.26	Chlorine	.15
Iron	5.08	Phosphorus	.09
Calcium	3.51	Manganese	.07
Magnesium	2.50	Sulphur	.04
Sodium	2.28	Barium	.03
Potassium	2.23	Nitrogen	.02
Hydrogen	.94	Chromium	.01

ELEMENTARY COMPOSITION OF THE HUMAN BODY.

	Per cent.	Pounds.
Oxygen	62.43	93.645
Carbon	21.15	51.725
Hydrogen	9.865	14.798
Nitrogen	3.1	4.65
Calcium	1.9	2.85
Phosphorus	.946	1.419
Potassium	.23	.345
Sulphur	.162	.243
Chlorine	.081	.121
Sodium	.081	.122
Magnesium	.027	.040
Iron	.014	.021
Fluorine	.014	.021
	100.	150.

HEAT OF COMBUSTION

SUBSTANCE.	CALORIES.	B. T. U.
Alcohol, ethyl	7,184	12,931
" methyl	5,330	9,594
" amyl	8,958	16,124
Benzene	10,030	18,054
Carbon, amorphous	8,080	14,544
Coal, bituminous	7,800	14,040
	9,000	16,200
" anthracite	7,800	14,040
" lignite	6,900	12,420
Coke	7,000	12,600
Gas, coal	4,440	7,990
	7,370	12,266
Acetylene	11,927	21,469
Ethylene	11,858	21,344
Methane	13,063	23,513
Hydrogen	34,462	62,032
Carbon monoxide	5,640	10,152
Oil, lard	9,300	16,740
" olive	9,473	17,051
Wood, hard	4,750	8,550
" soft resinous	5,050	9,090

A Calorie is the amount of heat required to raise 1 gramme of water 1 degree Centigrade.

A British Thermal Unit (B. T. U.) is the amount of heat required to raise 1 pound of water 1 degree Fahrenheit.

CHEMICAL SUBSTANCES AND THEIR COMMON NAMES.

COMMON NAME.	CHEMICAL NAME.
Alcohol	Ethyl alcohol
Alum	Potassium aluminium sulphate
Aqua fortis	Nitric acid
Aqua regia	Nitro-hydrochloric acid
Banana ether	Amyl acetate
Black lead	Graphite carbon
Borax	Sodium tetraborate
Brimstone	Sulphur
Calomel	Mercurous chloride
Carbolic acid	Phenol
Caustic potash	Potassium hydroxide
" soda	Sodium hydroxide
Chalk	Calcium carbonate
Choke damp	Carbon dioxide
Chrome yellow	Lead chromate
" green	Chromium oxide
Clay	Aluminum silicate
Copperas	Ferrous sulphate
Corrosive sublimate	Mercuric chloride
Cream of tartar	Potassium hydrogen tartrate
Epsom salts	Magnesium sulphate
Fire damp	Methane
Fusel oil	Amyl alcohol
Glauber's salt	Sodium sulphate
Grape sugar	Glucose
Goulard water	Basic lead acetate
Iron pyrites	Iron disulphide
Laughing gas	Nitrous oxide
Lime, quick	Calcium oxide
" slaked	" hydroxide
Litharge	Lead oxide
Lunar caustic	Silver nitrate

COMMON NAME.	CHEMICAL NAME.
Marsh gas	Methane
Mosaic gold	Stannic sulphide
Muriatic acid	Hydrochloric acid
Orpiment	Arsenic trisulphide
Paris green	Copper arsenite
Plaster of Paris	Calcium sulphate
Prussian blue	Ferric ferrocyanide
Realgar	Arsenic disulphide
Red lead	Lead oxide
Rochelle salt	Sodium potassium tartrate
Sal ammoniac	Ammonium chloride
Salt, common	Sodium chloride
Salt of tartar	Potassium carbonate
Saltpetre	" nitrate
Salts of lemon	Oxalic acid
Soda, washing	Sodium carbonate
" baking	" hydrogen carbonate
" ash	Sodium carbonate
Spirits of hartshorn	Ammonium hydroxide
Spirits of salt	Hydrochloric acid
Tartar emetic	Potassium antimonyl tartrate
Verdigris	Basic copper acetate
Vermilion	Mercuric sulphide
Vinegar	Acetic acid
Vitriol, blue	Copper sulphate
" green	Ferrous sulphate
" oil of	Sulphuric acid
" white	Zinc sulphate
Volatile alkali	Ammonium hydroxide
White lead	Basic lead carbonate
Wood alcohol	Methyl alcohol
Zinc white	Zinc oxide

SPECIFIC GRAVITY.

To Convert Degrees Baumé into Specific Gravity.—(1) For liquids heavier than water: Subtract the degree of Baumé from 145 and divide into 145. The quotient is the specific gravity.

(2) For liquids lighter than water: Add the degree of Baumé to 130 and divide it into 140. The quotient is the specific gravity.

To Convert Specific Gravity into Degrees Baumé.—(1) For liquids heavier than water: Divide the specific gravity into 145 and subtract from 145. The remainder is the degree of Baumé.

(2) For liquids lighter than water: Divide the specific gravity into 140 and subtract 130 from the quotient. The remainder will be the degree of Baumé.

COMPARISON OF DEGREES TWADDELL AND SPECIFIC GRAVITY.

In order to change degrees Twaddell into specific gravity, multiply by 5, add 1.000 and divide by 1,000.

Example: Change 168 deg. Twaddell into specific gravity.

$$168 \times 5$$

$$840$$

$$1{,}000$$

$$1{,}000)1{,}840$$

1.84, specific gravity.

To change specific gravity into degrees Twaddell, multiply by 1,000, subtract 1,000 and divide by 5.

Example: Change 1.84 specific gravity to degrees Twaddell.

$$1.84 \times 1{,}000$$

$$1{,}840$$

$$1{,}000$$

$$5)840$$

168° Tw.

SPECIFIC GRAVITY.

Determination of Specific Gravity: Solids: (1) Solids heavier than, and insoluble in water:

a. By weighing in air and water.—

$$\text{Sp. gr.} = \frac{\text{(weight in air)}}{\text{(loss of weight in water)}}$$

b. By Nicholson's hydrometer. Let w_1 be the weight required to sink the instrument to the mark on the stem; to take the specific gravity of any solid substance, place a portion of it weighing less than w_1 in the upper pan, with such additional weight, say w_2, as will cause the instrument to sink to the zero mark. The weight of the substance is then $w_1 - w_2$. Next transfer the substance to the lower pan, and again adjust with weight w_4 to the zero mark.

$$\text{Sp. gr.} = \frac{w_1 - w_3}{w_4 - w_3}$$

c. By the specific gravity bottle (applicable to powders). Weigh the flask filled to the mark with water, then place the substance, of known weight, in the flask, fill to the mark with water, and weigh again.

$$\text{Sp. gr.} = \frac{\text{weight of substance in air}}{\text{wt. in air} + \text{wt. of flask and water} - \text{wt. of flask filled with substance and water.}}$$

(2) Solids lighter than and insoluble in water. The solid is weighted with a piece of lead and weighed in water.

$$\text{Sp. gr.} = \frac{\text{(weight of substance in air)}}{\text{(wt. of lead in water)} - \text{(wt. of lead and substance in water)} + \text{(wt. of substance in air)}}$$

(3) Solids heavier than and soluble in water. Proceed as in 1 *a*, using instead of water some liquid without action on the solid.

(weight of bulk of liquid equal to substance) = (weight of substance in air) — (weight of substance in liquid).

$$\text{(wt. of bulk of water equal to substance)} = \frac{\text{(wt. of bulk of liquid equal to substance)}}{\text{(sp. gr. of liquid)}}$$

$$\text{Sp. gr.} = \frac{\text{(weight of substance in air)}}{\text{(weight of bulk of water equal to substance)}}$$

Liquids: (1) By the hydrometer.

(2) By the specific gravity bottle. Weigh the bottle filled to the mark with water, and again when filled to the mark with liquid.

$$\text{Sp. gr.} = \frac{\text{(weight of liquid and bottle)} - \text{(weight of bottle)}}{\text{(weight of water and bottle)} - \text{(weight of bottle)}}$$

Tables of Specific Gravity will be found under Weights and Measures.

SPECIFIC GRAVITY.

Tables showing a comparison of the degrees of Baumé, Cartier, and Beck's Areometers, with specific gravity degrees.

For Liquids Lighter than Water.			
Degrees of Baumé, Cartier, Beck.	Baumé. Sp. Gr.	Cartier. Sp. Gr.	Beck. Sp. Gr.
0	.....	.....	1.0000
1	.....	.....	0.9941
2	.....	.....	0.9883
3	.....	.....	0.9826
4	.....	.....	0.9770
5	.....	.....	0.9714
6	.....	.....	0.9659
7	.....	.....	0.9604
8	.....	.....	0.9550
9	.....	.....	0.9497
10	1.000	.....	0.9444
11	0.993	1.000	0.9392
12	0.986	0.992	0.9340
13	0.979	0.985	0.9289
14	0.973	0.977	0.9239
15	0.967	0.969	0.9189
16	0.960	0.962	0.9139
17	0.954	0.955	0.9090
18	0.948	0.948	0.9042
19	0.942	0.941	0.8994
20	0.935	0.934	0.8947
21	0.929	0.927	0.8900
22	0.924	0.920	0.8854
23	0.918	0.914	0.8808
24	0.912	0.908	0.8762
25	0.906	0.901	0.8717
26	0.901	0.895	0.8673
27	0.895	0.889	0.8629
28	0.889	0.883	0.8585
29	0.884	0.877	0.8542
30	0.879	0.871	0.8500
31	0.873	0.865	0.8457
32	0.868	0.859	0.8415
33	0.863	0.853	0.8374
34	0.858	0.848	0.8333
35	0.853	0.842	0.8292
36	0.848	0.837	0.8252
37	0.843	0.831	0.8212
38	0.838	0.826	0.8173
39	0.833	0.820	0.8133
40	0.829	0.815	0.8095
41	0.824	0.810	0.8061
42	0.819	0.805	0.8018
43	0.815	0.800	0.7981
44	0.810	.....	0.7944
45	0.806	.....	0.7907
46	0.801	.....	0.7871
47	0.797	.....	0.7834
48	0.792	.....	0.7799
49	0.788	.....	0.7763
50	0.784	.....	0.7727
51	0.781	.....	0.7692
52	0.776	.....	0.7658
53	0.771	.....	0.7623
54	0.769	.....	0.7589
55	0.763	.....	0.7556
56	0.759	.....	0.7522
57	0.755	.....	0.7489
58	0.751	.....	0.7456
59	0.748	.....	0.7423
60	0.744	.....	0.7391
61	0.740	.....	0.7359
62	0.736	.....	0.7328

For Liquids Heavier than Water.		
Degrees of Baumé, Beck.	Baumé. Sp. Gr.	Beck. Sp. Gr.
0	1.000	1.0000
1	1.007	1.0059
2	1.014	1.0119
3	1.020	1.0180
4	1.028	1.0241
5	1.034	1.0303
6	1.041	1.0366
7	1.049	1.0429
8	1.057	1.0494
9	1.064	1.0559
10	1.072	1.0625
11	1.080	1.0692
12	1.088	1.0759
13	1.096	1.0828
14	1.104	1.0897
15	1.113	1.0968
16	1.121	1.1039
17	1.130	1.1111
18	1.138	1.1184
19	1.147	1.1258
20	1.157	1.1333
21	1.166	1.1409
22	1.176	1.1486
23	1.185	1.1565
24	1.195	1.1644
25	1.205	1.1724
26	1.215	1.1806
27	1.225	1.1888
28	1.235	1.1972
29	1.245	1.2057
30	1.256	1.2143
31	1.267	1.2230
32	1.278	1.2319
33	1.289	1.2409
34	1.300	1.2500
35	1.312	1.2593
36	1.324	1.2680
37	1.337	1.2782
38	1.349	1.2879
39	1.361	1.2977
40	1.375	1.3077
41	1.388	1.3178
42	1.401	1.3281
43	1.414	1.3386
44	1.428	1.3492
45	1.442	1.3600
46	1.456	1.3710
47	1.470	1.3821
48	1.485	1.3934
49	1.500	1.4050
50	1.515	1.4167
51	1.531	1.4286
52	1.546	1.4407
53	1.562	1.4530
54	1.578	1.4655
55	1.596	1.4783
56	1.615	1.4912
57	1.634	1.5044
58	1.653	1.5179
59	1.671	1.5315
60	1.690	1.5454
61	1.709	1.5596
62	1.729	1.5741
63	1.750	1.5888
64	1.771	1.6038

THERMOMETER SCALES.

Much annoyance is caused by the great difference of thermometer scales in use in the different civilized countries. The scale of Reaumur prevails in Germany. As is well known, he divides the space between the freezing and boiling points into 80 deg. France uses that of Celsius, who graduated his scale on the decimal system. The most peculiar scale of all, however, is that of Fahrenheit, a renowned German physicist, who in 1714 or 1715, composed his scale, having ascertained that water can be cooled under the freezing point, without congealing. He therefore did not take the congealing point of water, but composed a mixture of equal parts of snow and sal ammoniac, about —14 deg. R. The conversion of any one of these scales to another is very simple, and easily made. To change a temperature as given by Fahrenheit's scale into the same as given by the centigrade scale subtract 32 deg. from Fahrenheit's degrees, and multiply the remainder by 5-9. The product will be the temperature in centigrade degrees.

To change from Fahrenheit's to Reaumur's scale, subtract 32 deg. from Fahrenheit's degrees, and multiply the remainder by 4-9. The product will be the temperature in Reaumur's degrees.

COMPARATIVE SCALES OF THERMOMETER.

C.	R.	F.	C.	R.	F.	C.	R.	F.
−30	−24.0	−22.0	14	11.2	57.2	58	46.4	136 4
−29	−23.2	−20.2	15	12.0	59.0	59	47.2	138.2
−28	−22.4	−18.4	16	12.8	60.8	60	48.0	140.0
−27	−21.6	−16.6	17	13.6	62.6	61	48.8	141.8
−26	−20.8	−14.8	18	14.4	64.4	62	49.6	143.6
−25	−20.0	−13.0	19	15.2	66.2	63	50.4	145.4
−24	−19.2	−11.2	20	16.0	68.0	64	51.2	147.2
−23	−18.4	−9.4	21	16.8	69.8	65	52.0	149.0
−22	−17.6	−7.6	22	17.6	71.6	66	52.8	150.8
−21	−16.8	−5.8	23	18.4	73.4	67	53.6	152.6
−20	−16.0	−4.0	24	19.2	75.2	68	54.4	154.4
−19	−15.2	−2.2	25	20.0	77.0	69	55.2	156.2
−18	−14.4	−0.4	26	20.8	78.8	70	56.0	158.0
−17	−13.6	1.4	27	21.6	80.6	71	56.8	159.8
−16	−12.8	3.2	28	22.4	82.4	72	57.6	161.6
−15	−12.0	5.0	29	23.2	84.2	73	58.4	163.4
−14	−11.2	6.8	30	24.0	86.0	74	59.2	165.2
−13	−10.4	8.6	31	24.8	87.8	75	60.0	167.0
−12	−9.6	10.4	32	25.6	89.6	76	60.8	168.8
−11	−8.8	12.2	33	26.4	91.4	77	61.6	170.6
−10	−8.0	14.0	34	27.2	93.2	78	62.4	172.4
−9	−7.2	15.8	35	28.0	95.0	79	63.2	174.2
−8	−6.4	17.6	36	28.8	96.8	80	64.0	176.0
−7	−5.6	19.4	37	29.6	98.6	81	64.8	177.8
−6	−4.8	21.2	38	30.4	100.4	82	65.6	179.6
−5	−4.0	23.0	39	31.2	102.2	83	66.4	181.4
−4	−3.2	24.8	40	32.0	104.0	84	67.2	183.2
−3	−2.4	26.6	41	32.8	105.8	85	68.0	185.0
−2	−1.6	28.4	42	33.6	107.6	86	68.8	186.8
−1	−0.8	30.2	43	34.4	109.4	87	69.6	188.6
0	0.0	32.0	44	35.2	111.2	88	70.4	190.4
1	0.8	33.8	45	36.0	113.0	89	71.2	192.2
2	1.6	35.6	46	36.8	114.8	90	72.0	194.0
3	2.4	37.4	47	37.6	116.6	91	72.8	195.8
4	3.2	39.2	48	38.4	118.4	92	73.6	197.6
5	4.0	41.0	49	39.2	120.2	93	74.4	199.4
6	4.8	42.8	50	40.0	122.0	94	75.2	201.2
7	5.6	44.6	51	40.8	123.8	95	76.0	203.0
8	6.4	46.4	52	41.6	125.6	96	76.8	204.8
9	7.2	48.2	53	42.4	127.4	97	77.6	206.6
10	8.0	50.0	54	43.2	129.2	98	78.4	208.4
11	8.8	51.8	55	44.0	131.5	99	79.2	210.2
12	9.6	53.6	56	44.8	132.8	100	80.0	212.0
13	10.4	55.4	57	45.6	134.6			

To change the temperature as given by the centigrade scale into the same as given by Fahrenheit, multiply the centigrade degrees by 9-5 and add 32 deg. to the product. The sum will be the temperature by Fahrenheit's scale.

To change from Reaumur's to Fahrenheit's scale, multiply the degrees on Reaumur's scale by 9-4 and add 32 deg. to the product. The sum will be the temperature by Fahrenheit's scale.

For those who wish to save themselves the trouble we have calculated the preceding comparative table.

CHAPTER II.

ASTRONOMY AND TIME.

EDITED BY A. RUSSELL BOND.

ASTRONOMICAL SYMBOLS AND ABBREVIATIONS.

☉	The Sun.	°	Degrees.
☾	The Moon.	′	Minutes of Arc.
☿	Mercury.	″	Seconds of Arc.
♀	Venus.	N.	North. S. South.
⊕ or ♁	The Earth.	E.	East. W. West.
♂	Mars.		°
♃	Jupiter.	0.	♈ Aries..... 0
♄	Saturn.	I.	♉ Taurus..... 30
♅	Uranus.	II.	♊ Gemini..... 60
♆	Neptune.	III.	♋ Cancer..... 90
☌	Conjunction.	IV.	♌ Leo..... 120
□	Quadrature.	V.	♍ Virgo..... 150
☍	Opposition.	VI.	♎ Libra..... 180
☊	Ascending Node.	VII.	♏ Scorpio..... 210
		VIII.	♐ Sagittarius .240
☋	Descending Node.	IX.	♑ Capricornus. 270
		X.	♒ Aquarius.. .300
		XI.	♓ Pisces..... 330

h Hours.
m Minutes of Time.
s Seconds of Time.

THE EARTH.

The Earth rotates at a velocity of 15 degrees an hour (about 17,366 miles a minute at the Equator); 1° is therefore equal to 4 minutes.

The Circumference of the Globe is about 24,855 miles, and the diameter about 7,900 miles. More exactly:

	miles.
Earth's Equatorial Semi-diameter =	3963.296
" Polar " " =	3949.790
" Mean " " =	3958.794
" Oblateness = $\frac{1}{305}$	
1° of latitude at pole..... =	69.407
1° " equator..... =	68.704

The temperature increases on an average about 1° F. for every 64 feet descent. But this amount is variable according to the locality, geological formation, and dip of strata. In the Calumet and Hecla Mines, observations show an increase of 1° in about every 125 feet. At Bendigo it is shown to be 1° per 80 feet of descent. At Ronchamp Collieries, on the other hand, the temperature increases 1° F. in only 49 feet.

The mean density of the earth is 5.53 times as great as that of an equal bulk of water.

Area in sq. miles:

Africa.....	11,514,000
North America.....	6,446,000
South America.....	6,837,000
Asia.....	14,710,000
Australasia.....	3,288,000
Europe.....	3,555,000
Polar Regions.....	4,888,800
Total.....	51,238,800

Total surface.....	196,971,984 sq. miles
Cubic contents..	259,944,035,515 cubic miles
	Feet.
Greatest depth of sea (Pacific O.).....	30,000
(Atlantic).....	27,366
Highest mountain (Himalaya).....	29,002
Highest balloon ascent above the earth.	37,000
" " " (without man)..	95,280

By combining a large number of analyses of rocks of all sorts, F. W. Clarke has estimated the relative amounts of elements in the crust of the earth:

	Per cent.		Per cent.
Oxygen.....	47.02	Manganese.....	.07
Silicon.....	28.06	Sulphur.....	.07
Aluminium.....	8.16	Barium.....	.05
Iron.....	4.64	Strontium.....	.02
Calcium.....	3.50	Chromium.....	.01
Magnesium.....	2.62	Nickel.....	.01
Sodium.....	2.63	Lithium.....	.01
Potassium.....	2.32	Chlorine.....	.01
Titanium.....	.41	Fluorine.....	.01
Hydrogen.....	.17		
Carbon.....	.12		100
Phosphorus....	.09		

—*Science Year Book.*

The Earth is not always at the same distance from the Sun. In the Nautical Almanac the sun's apparent semi-diameter is given for every day in the year. The apparent semi-diameter was 16′ 17″. 89 on January 1st, 1912, and on July 1st of the same year it was 15′ 45″. 68. This proves that a greater distance separates us from the sun in summer than in winter.

PERIHELION AND APHELION.—When the earth is nearest to the sun it is said to be in *Perihelion*, and when farthest from the sun it is said to be in *Aphelion*.

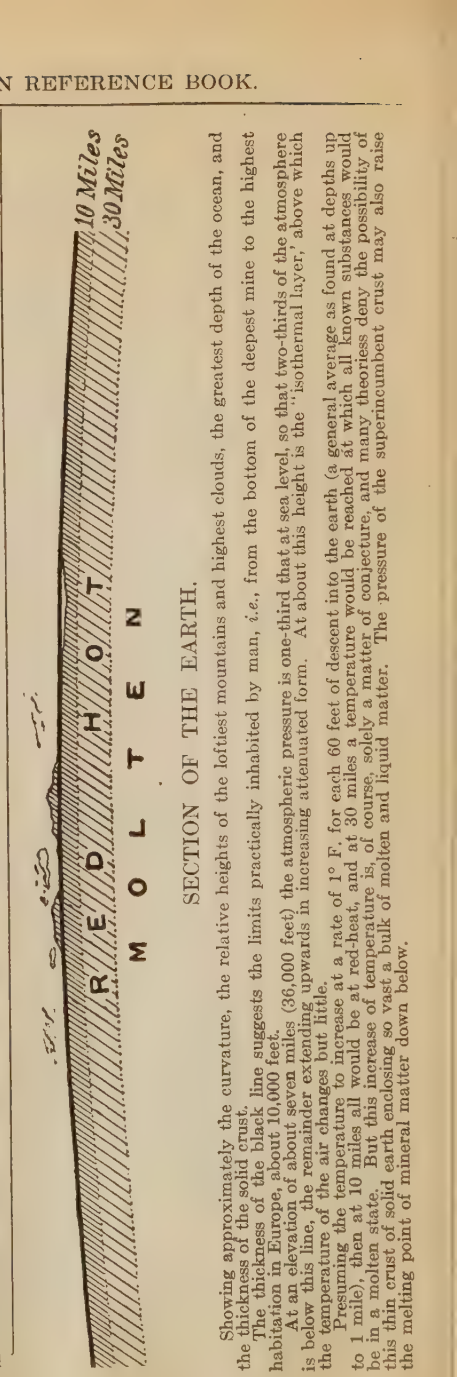
THE EARTH MOVES WITH VARYING VELOCITY IN ITS ORBIT.—This is ascertained by measuring the sun's longitude for two successive days at different times of the year, by which means it is found in December to move over 61′10.0″ within a period of twenty-four hours, while in June it only moves over 57′10.8″ in the same time.

KEPLER'S LAW OF EQUAL AREAS.—Kepler found that the line joining the center of the sun with the center of the earth moved over equal areas in equal times, that is, the greater distance of the earth from the sun in June compensated for the smaller arc of motion in longitude, so that lines drawn from the sun to the extremities of the arcs moved over make equal triangles.

REVOLUTION OF THE EARTH IN ITS ORBIT.—The stars which are seen nearest to the sun after sunset at different times of the year are not the same, but belong to different signs of the zodiac. This change of position of the sun with respect to the stars takes place at the rate of about 1° a day, so that the whole heavens appear to revolve once in a year independent of their diurnal revolution. This is due to the real revolution of the earth in its orbit. The stars appear to describe little ellipses in the course of a year, but, as a matter of fact, it is the light coming from the stars that is displaced by the motion of the earth in its orbit. This phenomenon is known as the *aberration of light*. There is also an apparent displacement of the nearer stars with respect to those more distant, which is known as *annular parallax* and is used to measure the distance of stars; for the greater the displacement the nearer must be the star.

THE MOON.

The moon, our only satellite, is on the average 238,850 miles away, measuring from centre of the earth to the centre of the moon. Its maximum distance is 252,830 and minimum 221,520. After subtracting the semi-diameter of the earth, and the semi-diameter of the moon from this figure, we find that the minimum possible distance between the surfaces of the planets is 216,476 miles. The moon is only 2,162 miles in diameter, and its surface area is 14,685,000 miles, or a little less than the combined areas of North and South America. The volume of the earth is 49 times that of the moon and its weight, or more strictly speaking, its mass, is 81 times greater. A man weighing 140 pounds on earth would weigh but 21 pounds on the moon. The surface of the moon is covered with tall mountains reaching 20,000 feet high, with deep craters and crevasses. The moon has no atmosphere and apparently is a dead world. It revolves about the earth once in 27d., 7h., 43m., 11.55s. or 27.32166 days. However, as the earth is also revolving about the sun the synodical period or the time from new moon to new moon is 29d., 12h., 44m., 2.86s. or 29.53059 days. During the synodical period the moon makes one complete rotation about its axis, and hence the moon's day is almost a month long. During this period it keeps the same face always toward the earth. However, we can see more than half of the moon because the moon's axis is inclined 5° 8′ from the perpendicular to its orbit, so that we can see alternately its north and south pole. Also because its angular velocity about its orbit varies, we can see a little more now of the western side and now of the eastern. The moon does not revolve about the centre of the earth, but about a centre of gravity common to both earth and moon. This centre is 1,063 miles below the surface of the earth. The earth's revolutions about this centre are known as *librations*. The plane of the moon's orbit is also inclined to the earth's orbit 5° 5′. The points where this plane crosses the plane of the earth's orbit are called the *nodes*. Eclipses occur only when the moon is at or near the nodes. For only then can its shadow fall on the earth or the earth's shadow fall on the moon. The nodes are not fixed, but move at the rate of one complete revolution in 18y., 218d., 21h., 22m., 46s. This period was known to the ancients as a *saros* for it was noted that eclipses repeated themselves at the lapse of such a period.



SECTION OF THE EARTH.

Showing approximately the curvature, the relative heights of the loftiest mountains and highest clouds, the greatest depth of the ocean, and the thickness of the solid crust. The thickness of the black line suggests the limits practically inhabited by man, *i.e.*, from the bottom of the deepest mine to the highest habitation in Europe, about 10,000 feet.

At an elevation of about seven miles (36,000 feet) the atmospheric pressure is one-third that at sea level, so that two-thirds of the atmosphere is below this line, the remainder extending upwards in increasing attenuated form. At about this height is the 'isothermal layer,' above which the temperature of the air changes but little.

Presuming the temperature to increase at a rate of 1° F. for each 60 feet of descent into the earth (a general average as found at depths up to 1 mile), then at 10 miles all would be at red-heat, and at 30 miles a temperature would be reached at which all known substances would be in a molten state. But this increase of temperature is, of course, solely a matter of conjecture, and many theories deny the possibility of this thin crust of solid earth enclosing so vast a bulk of molten and liquid matter. The pressure of the superincumbent crust may also raise the melting point of mineral matter down below.

The Sun.

—Solar Parallax (equatorial horizontal), 8.80″±0.02″. Mean distance of the sun from the earth, 92,885,000 miles; 149,480,000 kilometers. Variation of the distance of the sun from the earth between January and July, 3,100,000 miles; 4,950,000 kilometers. Linear value of 1″ on the sun's surface, 450.3 miles; 724.7 kilometers. Mean angular semi-diameter of the sun, 16′ 02.0″. Sun's linear diameter, 866,400 miles; 1,394,300 kilometers. (This may, perhaps, be *variable* to the extent of several hundred miles.) Ratio of the sun's diameter to the earth's 109.3. Surface of the sun compared with the earth, 11,940. Volume, or cubic contents, of the sun compared with the earth, 1,305,000. Mass, or quantity of matter, of the sun compared with the earth, 330,000±3000. Mean density of the sun compared with the earth, 0.253. Mean density of the sun compared with water, 1.406. Force of gravity on the sun's surface compared with that on the earth, 27.6. Distance a body would fall in one second, 444.4 feet; 135.5 meters. Inclination of the sun's axis to the ecliptic, 70° 15′. Longitude of its ascending node 74°. Date when the sun is at the node, June 4, 5. Mean time of the sun's rotation (Carrington), 25.38 days. Time of rotation of the sun's equator, 25 days. Time of rotation at latitude 20°, 25.75 days. Time of rotation at latitude 30°. 26.5 days. Time of rotation at latitude 45°, 27.5 days. (These last four numbers are somewhat doubtful, the formulæ of various authorities giving results differing by several hours in some cases.) Linear velocity of the sun's rotation at its equator, 1.261 miles per second; 2.028 kilometers per second. Total quantity of sunlight, 1,575,000,000,000,000,000,000,000,000 candles. Intensity of the sunlight at the surface of the sun, 190,000 times that of a candle flame; 5300 times that of metal in a Bessemer convertor; 146 times that of a calcium light; 3.4 times that of an electric arc. Brightness of a point on the sun's limb compared with that of a point near the center of the disk, 25 per cent. Heat received per minute from the sun upon a square meter, perpendicularly exposed to the solar radiation, at the upper surface of the earth's atmosphere (*the solar constant*), 20 calories. Heat radiation at the surface of the sun, per square meter per minute, 1,117,000 calories. Thickness of a shell of ice which would be melted from the surface of the sun per minute, 48½ feet, or 14¾ meters. Mechanical equivalent of the solar radiation at the sun's surface, continuously acting, 109,000 horse power per square meter; or, 10,000 (nearly) per square foot. Effective temperature of the solar surface about 5,000° C., or 9,000° F.

Ecliptic.—If the brilliance of the sun did not obscure the stars, in other words, if we were able to see the stars by day as we do at night, we should note that the sun travels eastward among them, making a complete revolution in a year. The path of the sun among the stars is known as the "Ecliptic." The angle (23½°) between the plane of the ecliptic and that of the celestial equator is known as the *obliquity of the ecliptic*. The sun's motion is only apparent. The plane of the ecliptic is really the plane of the earth's revolution about the sun, while the plane of the celestial equator is the plane of the earth's rotation on its axis.

Nodes.—The two points where the plane of the ecliptic crosses the plane of the celestial equator or equinoctial are called *nodes*, that point at which the sun appears to come up from below the equator being called the *ascending node*, and that at which the sun appears to descend from above the same plane being called the *descending node*.

The First Point of Aries.—The *ascending node* above referred to is the *first point of Aries*. It is universally used for fixing the right ascension of celestial bodies.

Precession and Nutation.—The sun and moon attract the protuberant portion of the earth's equator more on that side nearest to them than on that side farthest away, and in this way the differential attraction tends to tilt the axis a little, so that it describes a circle in about 25,800 years. The moon's differential attraction is greater than that of the sun. On account of the moon's continually changing its relation to the earth's equator, it causes the axis of the earth to describe a circle with a wavy circumference, known as *nutation*, or nodding of the earth's axis.

Latitude, Longitude, Right Ascension, and Declination.—Terrestrial latitude is measured from the equator to the poles, north and south. Terrestrial longitude is commonly measured from the meridian of Greenwich, but some countries use their own meridians. Right ascension is measured from the first point of Aries. Declination is measured from the celestial equator. Celestial longitude is measured from the first point of Aries, celestial latitude from the ecliptic.

SATELLITES OF THE SOLAR SYSTEM

Name	Stellar Magnitude	Mean Distance in Miles	Sidereal Period d. h. m. s.	Discoverer	Date
THE EARTH					
The Moon	..	238,840	27 7 43 11		
MARS					
1. Phobos	14	5,850	7 39 15	Asaph Hall	Aug. 17, 1877
2. Deimos	13	14,650	1 6 17 54	Asaph Hall	Aug. 11, 1877
JUPITER					
5. (Nameless)	13	113,500	11 57 23	Barnard	Sept. 9, 1892
1. Io	6½	261,000	1 18 27 33	Galileo	Jan. 7, 1610
2. Europa	6½	415,000	3 13 13 42	Galileo	Jan. 8, 1610
3. Ganymede	6	664,000	7 3 42 33	Galileo	Jan. 7, 1610
4. Callisto	7	1,167,000	16 16 32 11	Galileo	Jan. 7, 1610
6. (Nameless)	14	7,000,000	250 d.	Perrine	Dec. 1904
7. (Nameless)	16	7,300,000	265 d.	Perrine	Jan. 1905
8. (Nameless)	17	15,600,000	789 d.	Melotte	Jan. 1908
SATURN					
1. Mimas	15	117,000	22 37 0	W. Herschel	July 18, 1789
2. Enceladus	14	157,000	1 8 53 7	W. Herschel	Aug. 29, 1789
3. Tethys	11	186,000	1 21 18 28	J. D. Cassini	Mar. 21, 1684
4. Dione	11	238,000	2 17 41 9	J. D. Cassini	Mar. 21, 1684
5. Rhea	10	332,000	4 12 25 12	J. D. Cassini	Dec. 23, 1672
6. Titan	9	771,000	15 22 41 23	Huygens	Mar. 25, 1655
7. Hyperion	16	934,000	21 6 39 27	G. P. Bond	Sept. 16, 1848
8. Iapetus	11	2,225,000	79 7 54 17	J. D. Cassini	Oct. 25, 1671
9. Phœbe	17	8,000,000	546.5 d.	W.H.Pickering	1898
10. Themis	17	906,000	20 20 24 0	W.H.Pickering	1905
URANUS					
1. Ariel	15	120,000	2 12 29 21	Lassell	Oct. 24, 1851
2. Umbriel	16	167,000	4 3 27 37	Lassell	Oct. 24, 1851
3. Titania	13	273,000	8 16 56 29	W. Herschel	Jan. 11, 1787
4. Oberon	14	365,000	13 11 7 6	W. Herschel	Jan. 11, 1787
NEPTUNE					
1. (Nameless)	13	221,500	5 21 2 44	Lassell	Oct. 10, 1846

PRINCIPAL ELEMENTS OF THE SOLAR SYSTEM.

Name	Mean Distance from Sun		Sidereal Period		Mean Diam't'r Miles	Mass	Density	Volume	Axial Rotation
	⊕ = 1	Millions of Miles	Mean Solar Days	Years		⊕ = 1	Water = 1	⊕ = 1	
☿ Mercury	0 387	36.0	87 97	0 24	3030	0 476	4.7(?)	0 056	88d
♀ Venus	0 723	67.2	224 70	0 62	7700	0 82	4.94	0.92	225d
⊕ Earth	1 000	92.9	365 26	1 00	7917 6	1 00	5.55	1 00	23h 56m 4s
♂ Mars	1 524	141 5	686.95	1 88	4230	0 108	3 92	0 152	24h 37m 23s
♃ Jupiter	5 203	483 3	4332 58	11 86	86500	317 7	1 32	1309	9h 55m ±
♄ Saturn	9 539	886 0	10759 2	29 46	73000	94 8	0 72	760	10h 14m ±
♅ Uranus	19 183	1781 9	30686 8	84 02	31900	14 6	1 22	65	?
♆ Neptune	30 055	2971 6	60181 1	164 78	34800	17 0	1 11	85	?
☉ Sun	...	...	....	...	866400	332000	1.39	1300000	25d 7h 48m ±
☾ Moon	From ⊕ 238,840 mls		27.32	0.75	2163	1/81.5	3.39	0 020	27d 7h 43m

Observer's Handbook.

PERIODIC COMETS.

Name.	Perihelion Passage.	Period (Years.)	Perihelion Dist. Earth's Orbit = 1.	Eccentricity.
Encke	1885, Mar. 7	3.3	0.34	0.846
Tempel	1883, Nov. 20	5.2	1.34	0.553
Barnard	1890, Feb. 17	5.4	1.28	0.582
Tempel-Swift	1886, May 9	5.5	1.07	0.656
Brorsen	1879, Mar. 30	5.5	0.59	0.810
Winnecke	1886, Sept. 4	5.8	0.88	0.727
Tempel	1885, Sept. 25	6.5	2.07	0.405
Biela	1882, Sept. 23	6.6	0.86	0.755
D'Arrest	1884, Jan. 13	6.7	1.33	0.626
Faye	1881, Jan. 22	7.6	1.74	0.549
Tuttle	1885, Sept. 11	13.8	1.02	0.821
Pons-Brooks	1884, Jan. 25	71.5	0.77	0.955
Olbers	1887, Oct. 8	72.6	1.20	0.931
Halley	1910, Apr. 19	74.4	0.59	0.967

Shooting Stars.—The names of the principal meteor swarms and the dates of their appearance are as follows:—

Name.	Date.	Comet having same Orbit.
Andromedes	23 November	Biela's
Lyrids	20 April	Comet I. 1861
Leonids	15 November	Tempel's, 1866
Perseids	11 August	Comet III. 1863

Light Year

The distance that light can travel in a year is called a "Light Year" and is used by astronomers as a unit of linear measure.

Light travels in

1 second	186,330 miles
1 minute	11,179,800 "
1 hour	670,788,000 "
1 day	16,098,912,000 "
1 year	588,022,995,000 "

The earth's mean distance from the sun is also used as a unit of linear measure.

GREEK ALPHABET.

The different stars of the several constellations are usually indicated by the letters of the Greek alphabet. For convenience of reference, the alphabet is here given.

A α Alpha.	H η Eta.	N ν Nu.	T τ Tau.
B β Beta.	Θ θ Theta.	Ξ ξ Xi.	Y υ Upsilon.
Γ γ Gamma.	I ι Iota.	O ο Omicron.	Φ φ Phi.
Δ δ Delta.	K κ Kappa.	Π π Pi.	X χ Chi.
E ε Epsilon.	Λ λ Lambda	P ρ Rho.	Ψ ψ Psi.
Z ζ Zeta.	M μ Mu.	Σ ς Sigma.	Ω ω Omega.

NAMES OF THE PRINCIPAL STARS.

The following table exhibits the names of all the Stars of the First Three Magnitudes to which Astronomers have given names, at least all those whose names are in common use:

α	Andromedæ—Andromeda	Alpheratz.
β	"	Mirach Mizar.
γ	"	Almach.
α	Aquarii—Water Bearer	Sadalmelik.
β	"	Sadalsund.
δ	"	Skat.
α	Aquilæ—Eagle	Altair.
β	"	Alshain.
γ	"	Tarazed.
α	Arietis—Ram	Hamal.
β	"	Sheratan.
γ	"	Mesartim.
α	Aurigæ—Charioteer	Capella.
β	"	Menkalinan.
α	Boötis—Herdsman	Arcturus.
β	"	Nekkar.
ε	"	Izar, Mizar, Mirach.
η	"	Muphrid.
α	Canis Majoris—Great Dog	Sirius.
β	" "	Mirzam.
δ	" "	Adara.
β	Cygni—Swan	Albireo.
α	Draconis—Dragon	Thuban.
β	"	Alwaid.
γ	"	Etanin.
β	Eridani—River Eridanus	Cursa.
γ	"	Zaurac.
α	Geminorum—Twins	Castor.
β	"	Pollux.
γ	"	Alhena.
δ	"	Wesat.
ε	"	Mebsuta.
α	Herculis—Hercules	Ras Algethi.
β	"	Korneforos.
α	Hydræ—Sea Serpent	Al Fard, Cor Hydræ.
α	Leonis—Lion	Regulus, Cor Leonis.
β	"	Deneb Aleet, Denedola, Deneb.
γ	"	Algeiba.
δ	"	Zosma.
α	Leporis—Wolf	Arneb.
α	Libræ—Scales	Zuben el Genubi.
β	"	Zuben el Chamali.
γ	"	Zuben Hakrabi.
α	Lyræ—Lyre	Vega.
β	"	Sheliak.
γ	"	Sulaphat.
α	Ophiuchi—Serpent Bearer	Ras Alhague.
β	"	Cebalrai.
α	Orionis—Orion	Betelgeux.
β	"	Rigel.
γ	"	Bellatrix.
α	Canis Minoris—Little Dog	Procyon.
β	" "	Gomeisa.
α	Canum Venaticorum — Hunting Dogs	Cor Caroli.
α^2	Capricorni—Sea Goat	Secunda Giedi.
δ	"	Deneb Algiedi.
α	Cassiopeiæ—Cassiopeia	Schedar.
β	"	Chaph.
α	Cephei—Cepheus	Alderamin.
β	"	Alphirk.
γ	"	Errai.
α	Ceti—Whale	Menkar.
β	"	Diphda.
ζ	"	Baten Kaitos
o	"	Mira.
α	Columbæ—Dove	Phact.
α	Coronæ Borealis—Crown	Alphecca.
α	Corvi—Crow	Alchiba.
δ	"	Algores.
α	Crateris—Cup	Alkes.
α	Cygni—Swan	Arided, Deneb Adige.
δ	Orionis—Orion	Mintaka.
ε	"	Alnilam.
α	Pegasi—Pegasus	Markab.
β	"	Scheat.
γ	"	Algenib.
ε	"	Enif.
ζ	"	Homan.
α	Persei—Perseus	Mirfak.
β	"	Algol.
α	Piscis Australis—Southern Fish	Fomalhaut.
ε	Sagittarii—Archer	Kaus Australis.
α	Scorpionis—Scorpion	Antares, Cor Scorpionis.
α	Serpentis—Serpent	Unukalhai.
α	Tauri—Bull	Aldebaran.
β	"	Nath.
η	"	Alcyone (Pleiad).
α	Ursæ Majoris—Great Bear	Dubhe.
β	" "	Merak.
γ	" "	Phecda.
ε	" "	Alioth.
ζ	" "	Mizar.
η	" "	Alkaid, Benetnasch.
ι	" "	Talitha.
α	Ursæ Minoris—Little Bear	Polaris.
β	" "	Kochab.
α	Virginis—Virgin	Spica Azimech, Spica.
β	"	Zavijava.
ε	"	Vindemiatrix

In designating a star instead of writing α of Ursa Major or α of Gemini or α of Cassiopeia, it is customary to use the genitive form of the constellation name. Thus: α Ursae Majoris, α Geminorum, α Cassiopeiæ, etc.

STARS ARRANGED IN THE ORDER OF THEIR MAGNITUDE DOWN TO AND INCLUDING POLARIS

NAME OF STAR	Magnitude	R. A.			Dec.		
		h	m	s	°	′	″
α Canis Majoris—(*Sirius*)	− 1.6	6	41	16	−16	35	41
α Argûs—(*Canopus*)	− 0.9	6	22		−52	38	50
α Centauri	0.1	14	33	37	−60	28	22
α Lyrae—*Vega*)	0.1	18	33	58	+38	42	4
α Boötis—(*Arcturus*)	0.2	14	11	38	+19	38	25
α Aurigæ—(*Capella*)	0.2	5	10	11	+45	54	34
β Orionis—(*Rigel*)	0.3	5	10	18	−8	18	9
α Canis Minoris—(*Procyon*)	0.5	7	34	42	+5	27	4
α Aquilae—(*Altair*)	0.9	19	46	29	+8	38	7
β Centauri	0.9	13	57	36	−59	56	56
α Orionis—(*Betelgeux*)	0.9	5	50	24	+7	23	29
α Eridani—(*Achernar*)	1	1	34	26	−57	41	1
α Tauri—(*Aldebaran*)	1.1	4	30	52	+16	19	59
β Geminorum—(*Pollux*)	1.2	7	39	56	+28	14	22
α Scorpionis—(*Antares*)	1.2	16	24	1	−26	14	15
α Virginis—(*Spica*)	1.2	13	20	33	−10	42	8
α Cygni—(*Deneb*)	1.3	20	38	26	+44	57	55
α Leonis—(*Regulus*)	1.3	10	3	41	+12	23	51
α Pisc. Aust.—(*Fomalhaut*)	1.3	22	52	47	−30	5	20
β Crucis	1.5	12	42	34	−59	12	28
ε Canis Majoris	1.6	6	55	10	−28	51	6
α Crucis	1.6	12	21	42	−62	36	41
γ Crucis	1.6	12	26	17	−56	37	13
ε Argus	1.7	8	20	43	−59	13	34
γ Orionis—(*Bellatrix*)	1.7	5	20	25	+6	16	14
λ Scorpionis	1.7	17	27	38	−37	2	25
ε Ursae Majoris—(*Alioth*)	1.7	12	50	10	+56	26	14
β Argûs	1.8	9	12	14	−69	21	17
ε Orionis—(*Alnilam*)	1.8	5	31	45	−1	15	26
β Tauri	1.8	5	20	44	+28	32	2
γ Geminorum	1.9	6	32	38	+16	28	31
α Persei—(*Algenib*)	1.9	3	18	2	+49	32	56
α Triang. Aust.	1.9	16	39	20	−68	52	3
η Ursae Majoris—(*Alkaid*)	1.9	13	44	5	+49	45	8
δ Argûs	2	8	42	16	−54	23	9
β Canis Majoris	2	6	18	49	−17	54	41
δ Canis Majoris	2	7	4	49	−26	15	10
α Geminorum—(*Castor*)	2	7	28	59	+32	4	57
δ Orionis	2	5	36	19	−1	59	19
ε Sagittarii	2	18	18	20	−34	25	37
α Ursae Majoris—(*Dubhe*)	2	10	58	18	+62	13	35
β Aurigae	2.1	5	53	4	+44	56	22
α Ophiuchi	2.1	17	30	51	+12	37	24
α Pavonis	2.1	20	18	42	−57	1	4
ε Sagittarii	2.1	18	49	59	−26	24	25
α Ursae Minoris—(*Polaris*)	2.1	1	27	51	+88	50	11

DISTANCES OF THE NEARER STARS.

α Centauri	4.3	Light years	
Lalande 21,185	8.1	"	"
α Canis Majoris (*Sirius*)	8.7	"	"
τ Ceti	9.8	"	"
α Canis Minoris	10.1	"	"
61 Cygni	10.5	"	"
Groombridge 34	11.6	"	"
α Aquilae	13.7	"	"
Lalande 21,258	16.1	"	"
η Cassiopeiae	16.2	"	"
ξ Ursae Majoris	18.2	"	"
o Eridani	18.8	"	"
ζ Herculis	22.9	"	"
o Ceti (*Mira*)	22.9	"	"
α Pisc. Aust. (*Fomalhaut*)	23.6	"	"
β Leonis (*Denebola*)	25.3	Light years	
β Virginis	27.6	"	"
μ Cassiopeiae	29.1	"	"
γ Draconis	30.5	"	"
μ Herculis	30.8	"	"
γ Cygni	30.8	"	"
Groombridge 1830	32.0	"	"
α Lyrae (*Vega*)	34.7	"	"
θ Ursae Majoris	35.5	"	"
α Boötis (*Arcturus*)	43.5	"	"
β Cassiopeiae	44.1	"	"
α Ophiuchi	44.1	"	"
α Tauri (*Aldebaran*)	44.7	"	"
α Aurigae	49.4	"	"
β Gemini	50.9	"	"

THE NORTHERN HEAVENS.

The maps shown on the following pages represent the heavens as seen, on the different dates given, from stations in and about the latitude of New York (40° N). It is not an easy matter to recognize the stars by looking at the map. A certain amount of study is necessary; for, of course, the different stars of a constellation are not linked together by lines as they are in the map and furthermore their magnitude is very much exaggerated. The best plan for the novice is to start with a well known constellation, such as that of the Great Bear. The "Dipper" which is a part of the Great Bear is so conspicuous a group in the northern skies that anyone can point it out. Knowing the Dipper, the Pole Star may readily be discovered by tracing a line from β through α of the Dipper and about five times as far. Around the Pole Star (Polaris) which is of the second magnitude, the entire northern heavens appear to revolve once a day. Having found the Pole Star the constellation of Cassiopeia may be found by extending a line from ϵ of the Dipper through the Pole Star and as far again to the other side, where a cluster of stars in the form of a large ragged *W* will be found. If we run a line diagonally from α of the Dipper through γ and about eight or nine times as far again, we shall come to the first magnitude star Spica, in the constellation of the Virgin, while a line extended from α through β and about eight times as far again will bring us in the midst of the constellation of the Lion. At the eastern end of this constellation, is the second magnitude star Denebola, and the distance from this star to Spica is about the same as that from Spica to Arcturus, the first magnitude star in the constellation of Boötes. Thus we may proceed building up our knowledge of various groups and using these groups as reference points to find new constellations.

Contrary to custom in geographical maps, our star maps are drawn with the east on the lefthand side and the west on the righthand side, while north is at the top of the page and south at the bottom. This is due to the fact that the heavens are viewed looking upward, while the geographical map is viewed looking downward. In locating stars and constellations, it is best to hold the map overhead when the actual points of the compass and those marked on the map will bear the true relation to each other.

THE "DIPPER" AS AN INDEX TO THE HEAVENS.

NIGHT SKY: JANUARY AND FEBRUARY.

If one views the heavens on the hours specified under our map of January, he will find almost directly overhead a bright star with a triangle of lesser stars beside it. The bright star is Capella or the Little She Goat which is held on the arm of Auriga, the Charioteer, whose left hand is represented by the triangle of stars, η, ϵ, ζ. The constellation bears no resemblance whatever to a charioteer or a goat. In fact, very few constellations bear any resemblance to the objects the ancients supposed them to represent. Halfway between Capella and the southern horizon are the three bright stars forming the belt of Orion. They are indicated in the map ζ, ϵ, δ, and they are centered in the square formed by the stars, Betelgeux, Bellatrix, Rigel and the star noted by the letter κ. The little triangle of stars at λ mark the head of Orion, while the line of faint stars at π represents a lion skin that Orion is holding forth towards the constellation of Taurus, the Bull. The principal star of this constellation is Aldebaran, a bright red star, marking the left eye of the bull, while his two horns are indicated by the stars β and ζ. The star ϵ is at the right eye of the bull, and γ at his nose. They form with Aldebaran a triangle that is easily recognizable. A little to the west of this group is the interesting star cluster of the Pleiades. In this cluster, there are six stars easily visible to the naked eye, and many can see seven stars, while observers with exceptionally good eyesight have been able to see as many as fourteen stars. A small spyglass will reveal large numbers.

The stars forming the belt of Orion point in the general direction of the first magnitude star Sirius in the constellation of Canis Major, the Great Dog. Sirius is by far the brightest object in the heavens if we exclude the sun, moon and planets. It is one of the nearest suns outside our solar system, yet it is so far off that it takes nearly nine years for its light to reach us. The diameter of Sirius is about twenty times that of the sun and its volume is about seven thousand times greater. In the constellation of Canis Major there are

At 11 o'clock: Jan. 7
" 10:30 " " 14
" 10 " " 22

At 9 o'clock: Feb. 6
" 8:30 " " 14
" 8 " " 21

At 9:30 o'clock: January 29

NIGHT SKY: JANUARY AND FEBRUARY.

two other first magnitude stars, but Sirius so far outshines them that they look no brighter than second magnitude stars. If we follow the line from Aldebaran eastward beyond ζ we come to the constellation of Gemini, the Twins, marked by the two bright stars, Castor and Pollux; while south of this constellation is the first magnitude star Procyon in the constellation of Canis Minor, the Little Dog. It will be noticed that most of the constellations so far referred to lie adjacent to the Milky Way. If we follow the Galaxy northward, we find just beyond the constellation of Auriga, the constellation of Perseus, whose most interesting star is marked β and is known as Algol, the Demon Star or the Winking Demon. Every two days, twenty hours and forty-nine minutes, this star begins to fade until, in the course of three or four hours, it loses four-fifths of its light. Then it begins to become brighter until eventually, after three or four hours more, it reaches its normal brilliancy. The star marks the head of Medusa, which according to the Greek legend Perseus was carrying when he came across Andromeda chained to the rock. Further north along the Milky Way we come to Cassiopeia.

In the northeast is the great dipper forming part of Ursa Major, the Great Bear; far in the east is the constellation of Leo, the Lion, in which are the prominent stars Regulus, Denebola. The curved line of stars ending with Regulus is known as the Sickle,

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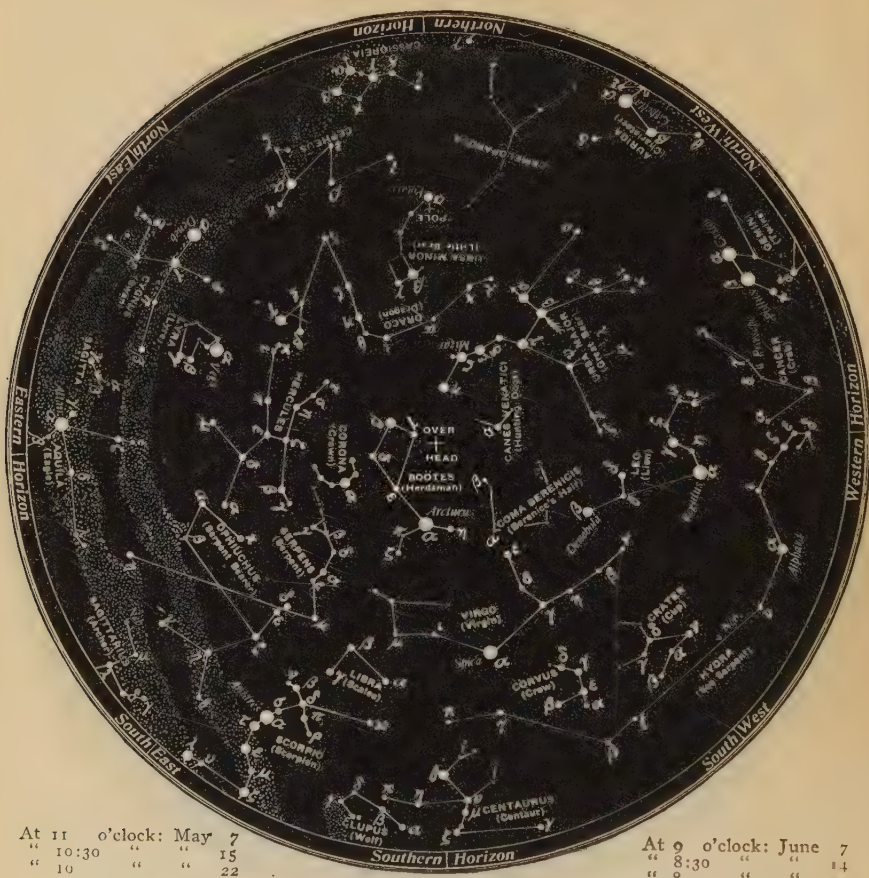
At 11 o'clock Mar. 8
" 10:30 " " 16
" 10 " " 23

At 9 o'clock Apr. 7
" 8:30 " " 14
" 8 " " 22

At 9:30 o'clock: March 30

NIGHT SKY: MARCH AND APRIL.

Our map for March and April shows most of the constellations along the Milky Way low in the western sky. The great dipper is well up near the zenith with its pointer stars β and α indicating the position of the Pole Star, Polaris. Oddly enough the ancients represented the great bear as having a long tail, indicated by the stars ϵ, ζ, η. These are the only stars that follow the outline of the beast. The star o is at the bear's mouth, while the stars κ, ι, and μ, λ, and ν, ξ represent three of his feet. The star ζ is interesting because it has a small companion, called by the Arabs as "Alcor." A little to the south of the zenith is the constellation of Leo, referred to in the previous paragraph. Below Leo are two small groups known as Corvus, the Crow, and Crater, the Cup. They are not very conspicuous; neither is Hydra, the Sea Serpent, which stretches its long length across the southern sky. Its brightest star is Alphard which is of the second magnitude. Above the head of the serpent is the inconspicuous constellation of Cancer, the Crab. An interesting feature of this constellation is a faint star cluster, just visible to the naked eye and marked on the map Praesepe, the "Beehive." In the telescope this is seen to be made up of a myriad of small bright stars.



At 11 o'clock: May 7
" 10:30 " " 15
" 10 " " 22

At 9 o'clock: June 7
" 8:30 " " 14
" 8 " " 22

At 9:30 o'clock: May 30

THE NIGHT SKY OF MAY AND JUNE.

The constellation nearest the zenith in May and June is that of Boötes, or the Herdsman. A bright red star, Arcturus, may be found in this constellation. It is known as the Wandering Star for the reason that it is slowly drifting with respect to the other stars in the Heavens. Since the time of Christ it has moved in a southwesterly direction, fully one degree, or through a distance equal to twice the diameter of the moon. Its yearly displacement is two seconds of arc. South of Boötes is the constellation of Virgo, whose brightest star is Spica. Between Virgo and Ursa Major are two faint constellations known as Coma Berenicis, Berenice's Hair, and Canes Venatici, the Hunting Dogs. Close to the southern horizon is the constellation of Centaurus, the Centaur. Not very much of this constellation can be seen from our latitude. Its brightest stars lie below the horizon. They include α Centauri, the nearest body outside the solar system. This star is only 255,000 times as far from us as we are from the sun. It takes its light $4\frac{1}{3}$ years to come to us. In the southeast, low down near the horizon may be seen the constellation of Scorpio, the Scorpion. This constellation is made up of a very easily recognizable group of stars. It contains the brilliant first magnitude star, Antares, at each side of which are the lesser stars σ and τ. A line of stars traces the form of the Scorpion as shown to better advantage in the next map. The Scorpion embraces in its claws the constellation Libra, or the Scales. In the north above the Polar Star, we may see

the body of the Little Bear, Ursa Minor. Most of the stars of this constellation are faint with the exception of Polaris and two stars β and γ which have been called the guards. Between Ursa Minor and the Zenith, the constellation Draco, or the Dragon, twines its long form. The stars γ, β and ξ mark the head of the dragon. To the eastward of the constellation Boötes is a partial ring of stars known as Corona, or the Crown. This is one of the few groups actually outlining the object it is supposed to represent.

At 11 o'clock: July 7
" 10:30 " " 14
" 10 " " 22

At 9 o'clock: Aug. 7
" 8:30 " " 14
" 8 " " 22

At 9:30 o'clock: July 30

NIGHT SKY: JULY AND AUGUST.

The Zenith constellation for July and August is Lyra, the Lyre, with its bright blue-white star, Vega, nearly directly overhead. Just west of the Zenith is the constellation Hercules whose stars form a ragged-looking *H*. Below this constellation is Ophiuchus who has in his grasp the constellation Serpens or the Serpent. Low down in the south the constellation of Scorpio has dragged its full length above the horizon and it is easy to trace its body and tail ending with the stars λ and υ. The opposite side of the Milky Way now stretches its length across the sky, containing in its extent many brilliant constellations. Just east of Scorpio is the constellation of Sagittarius, the Archer. Well up in the southeast is the star Altair of the constellation Aquila, the Eagle, and just above Altair is the tiny constellation, Sagitta or the Arrow. To the east may be seen Delphinus, the Dolphin, while to the east of Lyra is the constellation of Cygnus, the Swan.

At 11 o'clock; Sept. 6
" 10:30 " " 14
" 10 " " 21

At 9 o'clock: June 7
" 8:30 " " 14
" 8 " " 22

At 9:30 o'clock: September 29

NIGHT SKY: SEPTEMBER AND OCTOBER.

Our map for these two months shows no constellation immediately overhead. Halfway between the Zenith and the Pole Star is the constellation of Cephus, a badly formed *W* made up of stars that are not very bright, with the exception of α which is of second magnitude. The Milky Way now stretches overhead and makes a beautiful sight on a moonless night. About thirty degrees south of the Zenith is the constellation Pegasus. Its three stars, γ, α, and β form with the star α of the constellation Andromeda, a large square known as the "Square of Pegasus." Below the constellation Pegasus is that of Aquarius, the Water Bearer, while to the southwest is the zodiacal constellation of Capricornus, the Sea Goat. This constellation is marked by a very pretty naked eye double at α. The most conspicuous star in the south is Fomalhaut, of the Southern Fish. This brilliant star can hardly be appreciated in northern latitudes because it is not very favorably placed for observation. Below Fomalhaut is a bright little group known as Grus, the Crane.

At 11 o'clock: Nov. 7
" 10:30 " " 14
" 10 " " 22

At 9 o'clock: Dec. 7
" 8:30 " " 15
" 8 " " 23

At 9:30 o'clock: November 30

NIGHT SKY: NOVEMBER AND DECEMBER.

Running westward from the zenith stretches the constellation of Andromeda, the chained lady who was rescued by Perseus. In this constellation may be seen a faint nebula which in a telescope is shown to cover an enormous extent, a great whirl of nebulous material. Probably it represents a star in the making. The great square of Pegasus lies just to the south of the zenith. The southern sky is filled by the constellation of Cetus, the Whale. The most interesting star in this group is that of Mira, which on the average of once in eleven months, blazes forth with a brilliance, sometimes exceeding the second magnitude. Generally, however, it does not exceed the third magnitude, while its normal brightness is such that it is barely visible to the naked eye. Between Cetus and the zenith are three small constellations, *i. e.*, Pisces, the Fishes, Aries, the Ram, and Triangulus, the Triangle. In the southeast sky is the wandering river, Eridanus, while the eastern sky is filled with brilliant winter constellations described in the paragraph on the January and February map.

THE SOUTHERN HEAVENS.

The accompanying map shows all the stars clearly visible to the naked eye within 60 degrees of the south pole. Only parts of this region may be seen from stations north of the Equator and even south of the Equator the entire region cannot be seen at one time, except from stations below the sixtieth latitude. To adjust the map so as to show just what southern stars are in sight, from any given station at any day and hour,

MAP OF THE SOUTHERN HEAVENS.

proceed as follows: Add to the time as given by the clock (if the clock gives standard time greater accuracy may be obtained by correcting it to give the local time) the quantity given in the accompanying table for the current month, and add to this sum, four minutes for each day of the date. The result will be Sidereal time.

	h.	m.
January	18	39
February	20	41
March	22	32
April	0	34
May	2	32
June	4	34
July	6	31
August	8	35
September	10	37
October	12	35
November	14	38
December	16	36

Midnight should be counted as 12 hours, 1 A.M. as 13 hours, and so on, and, if the sum exceeds 24 hours, this amount should be subtracted from it. For example, for 1:15 A.M. on October 25th, we have:

	h.	m.
Clock time	13	15
From table, for October	12	35
$4 \times 25 = 100$ minutes, or	1	40
Sum	27	30
Subtract 24 hours	24	0
Sidereal time	3	30

The results of this calculation will be correct within four or five minutes at the most, if the observer's clock keeps local time. If it keeps standard time, the result should be corrected by the amount by which standard time is fast or slow of local time. For our present purpose this correction is usually hardly necessary.

Find now the point on the margin of the map corresponding to the sidereal time. Turn the map until the corresponding time on the margin is at the top. Then lay a straight edge across the map so that it passes above the center at a distance equal to the observer's latitude, (if north of the Equator). As the white circles on the map are 10 degrees, 20 degrees, etc., from the center this can be done very easily. The part of the map above the straight edge then represents the southern sky as it appears above the observer's horizon. For stations south of the Equator, the straight edge should be held below the center of the map, at a distance equal to the latitude.

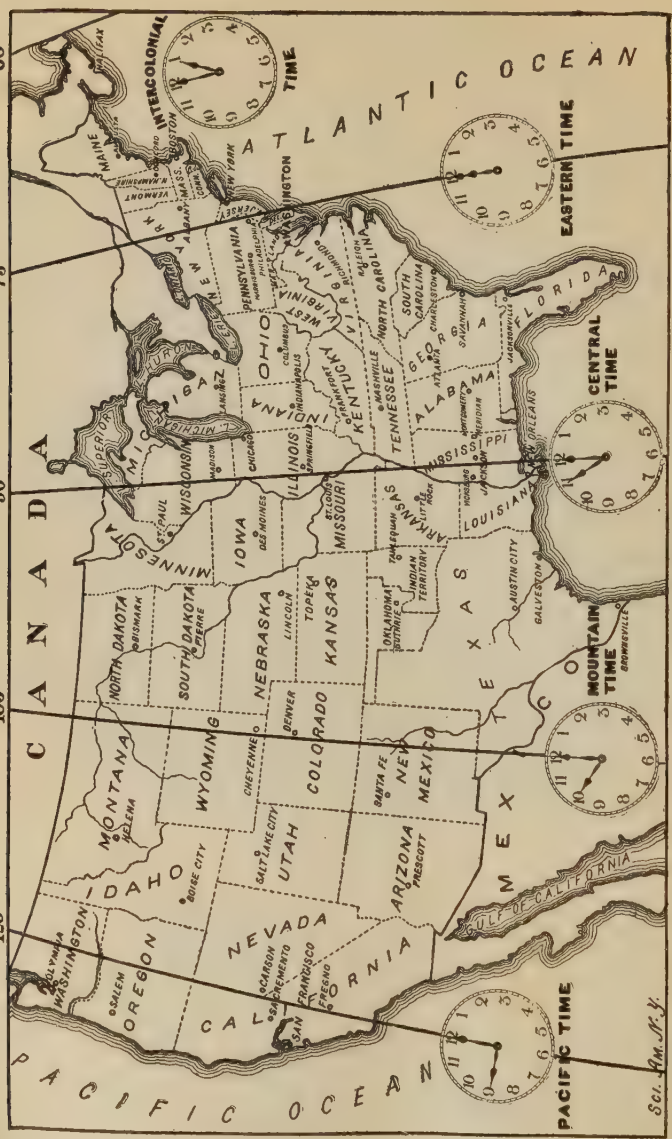
THE LARGE REFRACTORS OF THE WORLD.

INSTITUTION.	Aperture in Inches.	Focal Length in Feet.	Date of Erection.
Yerkes Observatory, Wisconsin, U. S. A.	40.0	62.0	1897
Lick Observatory, California, U. S. A.	36.0	57.8	1888
National Observatory, Meudon, France	32.5	53.0	1891
Astrophysical Observatory, Potsdam, Germany	31.1	39.4	.....
Bischoffsheim Observatory, Nice, France	30.3	52.6	1889
Imperial Observatory, Poulkova, Russia	30.0	42.0	1882
National Observatory, Paris, France	28.9	.....	.....
Royal Observatory, Greenwich, England	28.0	28.0	1894
Imperial Observatory, Vienna, Austria	27.0	34.0	1894
Royal Observatory, Greenwich, England	26.0	26.0	1897
Naval Observatory, Washington, U. S. A.	26.0	32.5	1871
Leander McCormick Observatory, Virginia, U. S. A.	26.0	32.5	1874
Cambridge University Observatory, England	25.0	.....	1868
National University, Meudon, France	24.4	52.2	1891
Harvard College, Cambridge, U. S.A.	24.0	11.3	1894
Royal Observatory, Cape of Good Hope, Africa	24.0	22.6	1897
Lowell Observatory, Flagstaff, Arizona, U. S. A.	24.0	31.0	1895
National Observatory, Paris, France	23.6	59.0	1889
Halstead Observatory, Princeton, U. S. A.	23.0	32.0	1881
City Observatory, Edinburgh, Scotland	22.0	30.0	.....
Etna, Italy	21.8	.....	.....
Buckingham Observatory, England	21.2	.....	.....
M. Porro, Private Observatory, Italy	20.5	.....	.....
Chamberlin Observatory, Colorado, U. S. A.	20.0	28.0	1891
Manila Observatory, Philippines	20.0	.....	1892
Astrophysical Observatory, Potsdam, Germany	19.7	41.2	.....
Imperial Observatory, Strassburg, Germany	19.1	23.0	1880
Milan Observatory, Italy	19.1	23.0	.....
Dearborn Observatory, Illinois, U. S. A.	18.5	27.0	1863
National Observatory, La Plata, Argentina	18.1	29.5	1890
Lowell Observatory, Flagstaff, Arizona, U. S. A.	18.0	26.3	1894
Flower Observatory, Philadelphia, U. S. A.	18.0	.....	1896
Royal Observatory, Cape of Good Hope, Africa	18.0	22.6	1897

—Knowledge Diary and Scientific Handbook.

SHOOTING A BULLET OFF THE EARTH.

When a bullet is fired from a horizontal gun, the curve of the path that it pursues is dependent upon the horizontal velocity of the bullet and gravity. The higher the horizontal velocity the flatter will be the curve and the further will the bullet travel before it strikes the earth. If the velocity of the bullet were 26,100 feet per second the curve of its path would be parallel to the circumference of the earth. Accordingly the bullet would pass around the earth without touching it, and return to its starting point in one hour and twenty-three minutes. It would continue to revolve about the earth as long as the velocity was maintained. At the same time it would be constantly attracted by the earth and would be forever falling away from a straight line towards the earth without ever reaching it. If the speed of the bullet were 37,000 feet per second it would fly off never to return to the earth.



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ZONES OF STANDARD TIME IN NORTH AMERICA.

TIME.

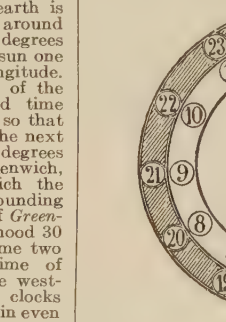
All calculations of time are based on the sun—not the real sun that we see, but a fictitious sun that keeps better time than the real sun. The time that is indicated by a sun dial is actual sun time or *Apparent Solar Time;* but this is not accurate enough for the civilized world because the day from noon to noon as marked by the real sun is longer at certain times of the year than at others. However, astronomers have constructed a fictitious sun that gives us days of uniform length, and the time it marks off is called *Mean Solar Time.* But this does not fully solve the problem of time. We have still to contend with the fact that the sun reaches the meridian successively later as it progresses westward, so that noon in Chicago, for instance, will be much later than noon in New York. In fact, noon on the west side of New York would come a few seconds later than noon on the east side. If each town in the country used local mean solar time, or *Local Time* as it is commonly called, the utmost confusion would prevail, particularly on railroads connecting the towns. To avoid this confusion it has been found necessary to establish certain zones in which uniform time is observed. It takes the sun twenty-four hours to circle the earth (to be sure it is the earth that moves, but for convenience we will consider that the earth is stationary and that the sun is moving around it). The earth is divided into 360 degrees of longitude. Therefore, it takes the sun one hour to traverse 15 degrees of longitude. The United States and the majority of the European countries have established time zones approximately 15 degrees wide, so that the time of one zone will differ from the next adjacent zones by an even hour. The degrees of longitude are measured from Greenwich, and at 15 degrees east of Greenwich the *Standard Time* used by the surrounding country will be just one hour ahead of *Greenwich Time.* Regions in the neighborhood 30 degrees east of Greenwich will use time two hours faster than the standard time of Greenwich. The same is true in the westward direction, except that here the clocks will be set slower than *Greenwich Time* in even hours at intervals of 15 degrees.

Eastern Time is taken from the 75th meridian, which being five times 15 degrees west of Greenwich, makes the time in this zone five hours slower than *Greenwich Time. Central Time* is taken from the 90th meridian and is one hour slower than *Eastern Time* and six hours slower than *Greenwich Time. Mountain Time* is taken from the 105th meridian, and *Pacific Time* from the 120th meridian. The zones are somewhat distorted, mainly to suit the convenience of railroads.

The movement which resulted in the adoption of the present time system may be said to have originated in a report on the subject by the American Meteorological Society which was submitted at a meeting of the General Time Convention held on October 13, 1881, proposing a single standard for the whole country and suggesting the hour theory as an alternative proposition. The proposal to fix one standard of time for the whole country had much to recommend it from a scientific point of view. But it was found to be impracticable on account of the many discrepancies which would occur between time by the clock and solar time. Accordingly the hour system was adopted at a meeting of the Convention held in April, 1883. At noon, on November 8, 1883, time signals were sent out from Washington in accordance with the new hour standard time.

In Europe each country is small enough to be included in a single zone. *Greenwich Time* is used in Belgium, France, Great Britain, Holland (railways and telegraph), Portugal, and Spain. *Central European Time,* which is one hour faster than *Greenwich Time,* is used by Austria-Hungary, Denmark, Germany, Italy, Norway, Servia, Sweden and Switzerland. *Eastern European Time,* two hours faster than *Greenwich,* is used by Bulgaria and Egypt, and, by Europeans, in Turkey, the native time in the last-named country being based on sunset, which being the end of the Turkish day, marks the hour of 12.

In Belgium, France, Italy and Spain railroad clock dials are divided into twenty-four hours, beginning with 0 at midnight and thus doing away with A. M. and P. M. In France and Portugal, clocks on the exterior of railroad stations are true, while those within are set five minutes slow.



TWENTY-FOUR AND TWELVE HOUR TIME COMPARED.

Were it possible for a person to travel westward around the world as fast as the sun, time would to him appear to be at a standstill. If he started, say at noon Monday, it would always be noon Monday to him, and apparently there would be no change in his calendar. Yet somewhere along his course around the world Monday must have ended and Tuesday must have begun. Were the traveler proceeding eastward he would in 12 hours meet and pass the sun on the opposite side of the earth and would apparently have reached the hour of noon Tuesday. At the end of 12 hours more he would meet the sun a second time and would have to tear off another leaf from his calendar and call the time noon, Wednesday. In other words, his journey around the globe would have taken him two days longer than the man who traveled with the sun and made the trip in no time. It is a fact that a trip around the earth in a west-

ward direction can actually be made in two days less than a trip in the eastward direction, although the same rate of speed is preserved; but the days of the east-bound traveler would be shorter than those of the west-bound traveler. In both cases the travelers would arrive with their calendars one day wrong; but a line has been established running north and south at which travelers are obliged to add a day if they cross it going westward or subtract a day if they cross it traveling eastward. In other words, the day is supposed to start and end along this line, which is called the *International Date Line.* It follows the 180th meridian except for a few digressions, as indicated in the map on the opposite page, to suit the convenience of inhabitants of islands lying nearby.

TABLE FOR THE CONVERSION OF TIME.

(To the nearest second.)

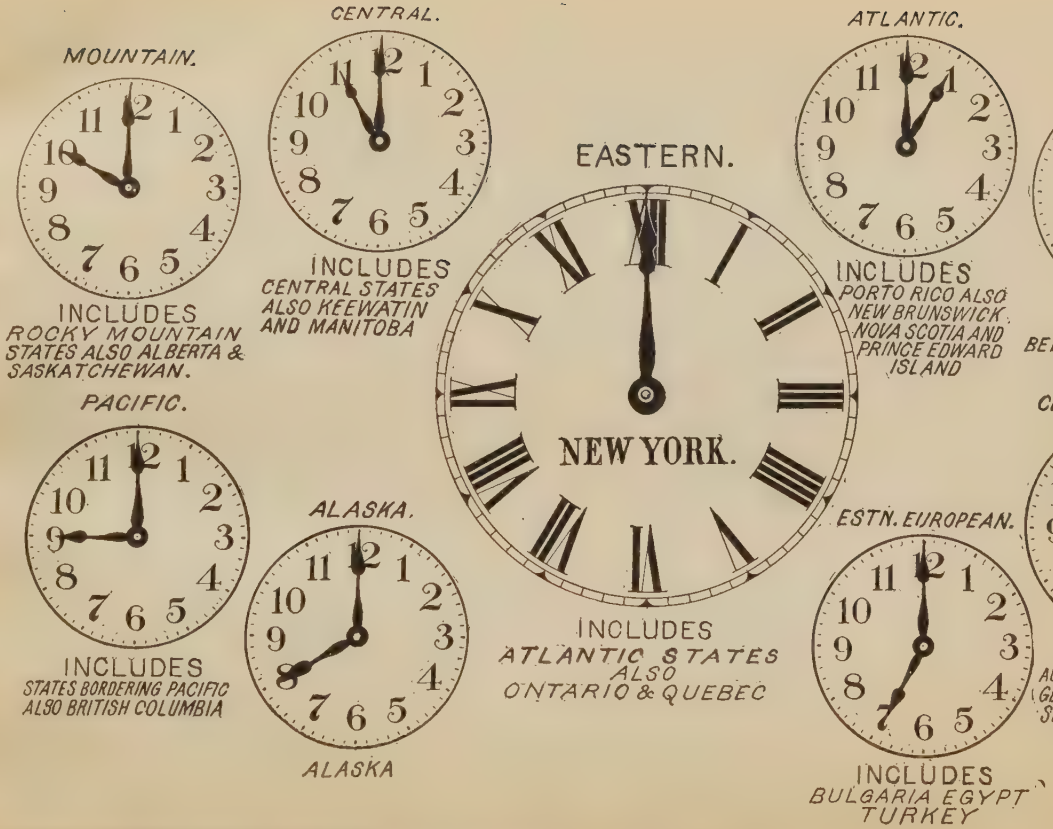
PLACE.	Earlier (−) or Later (+) than, East'n Stand'd.			Greenwich.		
	h	m	s	h	m	s
United States—						
From Maine to South Carolina	0	0	0	−5	0	0
From Dakota and Michigan to Texas and Florida	−1	0	0	−6	0	0
From Montana to Arizona and New Mexico	−2	0	0	−7	0	0
Pacific Coast States and Nevada	−3	0	0	−8	0	0
Sitka, Alaska	−4	0	0	−9	0	0
Hawaiian Islands	−5	30	0	−10	30	0
Tutuila, Samoa	−6	30	0	−11	30	0
Guam	+14	30	0	+9	30	0
Philippine Islands	+13	0	0	+8	0	0
Porto Rico	+1	0	0	−4	0	0
Panama Canal Zone	0	0	0	−5	0	0
Algeria	+5	9	21	+0	9	21
Argentina	+0	43	12	−4	16	48
Australia, western	+13	0	0	+8	0	0
Australia, central	+14	30	0	+9	30	0
Australia, eastern	+15	0	0	+10	0	0
Austria-Hungary	+6	0	0	+1	0	0
Belgium	+5	0	0	0	0	0
Borneo (British North) and Labuan	+13	0	0	+8	0	0
Brazil (Rio Janeiro)	+2	7	19	−2	52	41
British Columbia	−3	0	0	−8	0	0
Canada, eastern	0	0	0	−5	0	0
Canada, central	−1	0	0	+6	0	0
Chile	+0	17	14	−4	42	46
China (Shanghai)	+13	5	43	+8	5	43
China (Saigon)	+12	6	49	+7	6	49
Colombia	+0	3	6	−4	56	54
Costa Rica	−0	36	17	−5	36	17
Cuba	−0	29	26	−5	29	26
Denmark	+6	0	0	+1	0	0
Ecuador	−0	14	7	−5	14	7
Egypt	+7	0	0	+2	0	0
England	+5	0	0	0	0	0
Fiji Islands (Suva)	+16	53	44	+11	53	44
France	+5	0	0	+0	0	0
Germany	+6	0	0	+1	0	0
Gibraltar	+5	0	0	0	0	0
Greece	+6	34	53	+1	34	53
Holland	+5	0	0	0	0	0
Honduras	−1	0	0	−6	0	0
Hongkong	+13	0	0	+8	0	0
India (Madras)	+10	30	00	+5	30	00
Ireland	+4	34	39	−0	25	21
Italy	+6	0	0	+1	0	0
Jamaica (Kingston)	−0	7	11	−5	7	11
Japan	+14	0	0	+9	0	0
Java	+12	7	14	+7	7	14
Kiaochau	+13	0	0	+8	0	0
Korea	+14	0	0	+9	0	0
Madagascar (Tananarivo)	+8	10	7	+3	10	7
Malta	+6	0	0	+1	0	0
Mauritius	+8	50	13	+3	50	13
Mexico	−1	36	27	−6	36	27
Newfoundland (St. Johns)	+1	29	16	−3	30	44
New Zealand	+16	30	0	+11	30	0
Nicaragua	−0	45	10	−5	45	10
Norway	+6	0	0	+1	0	0

TABLE FOR THE CONVERSION OF TIME—*Continued.*

(To the nearest second.)

PLACE.	Earlier (−) or Later (+) than, East'n Stand'd.			Greenwich.		
Nova Scotia	+1	0	0	−4	0	0
Panama (Colon)	−0	19	39	−5	19	39
Peru	−0	9	3	−5	9	3
Portugal	+5	0	0	0	0	0
Russia (Pulkowa)	+7	1	19	+2	1	19
Russia (Irkutsk)	+11	57	5	+6	57	5
Russia (Vladivostok)	+13	47	31	+8	47	31
Salvador	−0	56	32	−5	56	32
Servia	+6	0	0	+1	0	0
Singapore	+11	55	25	+6	55	25
South Africa (British)	+7	0	0	+2	0	0
Spain	+5	0	0	0	0	0
Sweden	+4	0	0	+1	0	0
Switzerland	+6	0	0	+1	0	0
Tunis	+5	9	21	+0	9	21
Turkey	+7	0	0	+2	0	0
Uruguay	+1	15	11	−3	44	49
Venezuela	+0	32	16	−4	27	44

MAP SHOWING INTERNATIONAL DATE LINE



The small dials show what time it is in those states and countries of America and Europe that use Standard Greenwich time, when it is 12 o'clock in New York. France and Portugal have just adopted Greenwich time.

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CALENDAR FOR 200 YEARS.*

FROM THE INTRODUCTION OF NEW STYLE.

By Charles E. Benham.

OCT.	MAY	FEB. AUG. NOV.	MAR.	JUNE	SEP. DEC.	JAN. APR. JULY	14
MAY	FEB. AUG. NOV.	MAR.	JUNE	SEP. DEC.	JAN. APR. JULY	OCT.	13
FEB. AUG. NOV.	MAR.	JUNE	SEP. DEC.	JAN. APR. JULY	OCT.	MAY	12
MAR.	JUNE	SEP DEC.	JAN. APR. JULY	OCT.	MAY	FEB. AUG. NOV.	11
JUNE	SEP. DEC.	JAN. APR. JULY	OCT.	MAY	FEB. AUG. NOV.	MAR.	10
SEP. DEC.	JAN. APR. JULY	OCT.	MAY	FEB. AUG. NOV.	MAR.	JUNE	9
JAN. APR. JULY	OCT.	MAY	FEB. AUG. NOV.	MAR.	JUNE	SEP. DEC.	8
MAY	AUG.	FEB. MAR. NOV.	JUNE	SEP. DEC.	APR. JULY	JAN. OCT.	7
AUG.	FEB. MAR. NOV.	JUNE	SEP. DEC.	APR. JULY	JAN. OCT.	MAY	6
FEB. MAR. NOV.	JUNE	SEP. DEC.	APR. JULY	JAN. OCT.	MAY	AUG.	5
JUNE	SEP. DEC.	APR. JULY	JAN. OCT.	MAY	AUG.	FEB. MAR. NOV.	4
SEP. DEC.	APR. JULY	JAN. OCT.	MAY	AUG.	FEB. MAR. NOV.	JUNE	3
APR. JULY	JAN. OCT.	MAY	AUG.	FEB. MAR. NOV.	JUNE	SEP. DEC.	2
JAN. OCT.	MAY	AUG.	FEB. MAR. NOV.	JUNE	SEP. DEC.	APR. JULY	1

SUN.	M.	T.	W.	THU.	F.	SAT.	1	8	15	22	29
M.	T.	W.	THU.	F.	SAT.	SUN.	2	9	16	23	30
T.	W.	THU.	F.	SAT.	SUN.	M.	3	10	17	24	31
W	THU.	F.	SAT.	SUN.	M.	T.	4	11	18	25	
THU.	F.	SAT.	SUN.	M.	T.	W.	5	12	19	26	
F.	SAT.	SUN.	M.	T.	W.	THU.	6	13	20	27	
SAT.	SUN.	M.	T.	W.	THU.	F.	7	14	21	28	

1753 2	1754 3	1755 4	1756* 12	1757 7	1758 1	1759 2	1760* 10
1761 5	1762 6	1763 7	1764* 8	1765 3	1766 4	1767 5	1768* 13
1769 1	1770 2	1771 3	1772* 11	1773 6	1774 7	1775 1	1776* 9
1777 4	1778 5	1779 6	1780* 14	1781 2	1782 3	1783 4	1784* 12
1785 7	1786 1	1787 2	1788* 10	1789 5	1790 6	1791 7	1792* 8
1793 3	1794 4	1795 5	1796* 13	1797 1	1798 2	1799 3	1800 4
1801 5	1802 6	1803 7	1804* 8	1805 3	1806 4	1807 5	1808* 13
1809 1	1810 2	1811 3	1812* 11	1813 6	1814 7	1815 1	1816* 9
1817 4	1818 5	1819 6	1820* 14	1821 2	1822 3	1823 4	1824* 12
1825 7	1826 1	1827 2	1828* 10	1829 5	1830 6	1831 7	1832* 8
1833 3	1834 4	1835 5	1836* 13	1837 1	1838 2	1839 3	1840* 11
1841 6	1842 7	1843 1	1844* 9	1845 4	1846 5	1847 6	1848* 14
1849 2	1850 3	1851 4	1852* 12	1853 7	1854 1	1855 2	1856* 10
1857 5	1858 6	1859 7	1860* 8	1861 3	1862 4	1863 5	1864* 13
1865 1	1866 2	1867 3	1868* 11	1869 6	1870 7	1871 1	1872* 9
1873 4	1874 5	1875 6	1876* 14	1877 2	1878 3	1879 4	1880* 12
1881 7	1882 1	1883 2	1884* 10	1885 5	1886 6	1887 7	1888* 8
1889 3	1890 4	1891 5	1892* 13	1893 1	1894 2	1895 3	1896* 11
1897 6	1898 7	1899 1	1900 2	1901 3	1902 4	1903 5	1904* 13
1905 1	1906 2	1907 3	1908* 11	1909 6	1910 7	1911 1	1912* 9
1913 4	1914 5	1915 6	1916* 14	1917 2	1918 3	1919 4	1920* 12
1921 7	1922 1	1923 2	1924* 10	1925 5	1926 6	1927 7	1928* 8
1929 3	1930 4	1931 5	1932* 13	1933 1	1934 2	1935 3	1936* 11
1937 6	1938 7	1939 1	1940* 9	1941 4	1942 5	1943 6	1944* 14
1945 2	1946 3	1947 4	1948* 12	1949 7	1950 1	1951 2	1952* 10

* Leap Year.

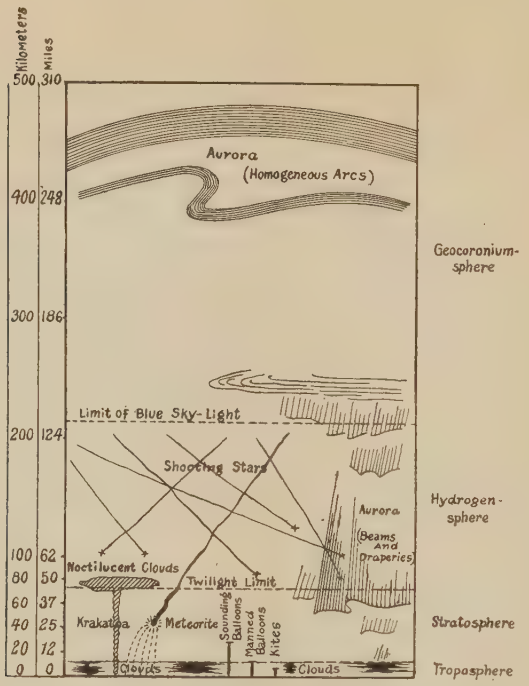
CALENDAR—1753 to 1952.

Under the year find its number. Take the month row in line with that number, as the heading of the Week-table below. The week-day for any date in that year will be found in line with the figure representing the day of the month.

Ex.: 1877 (2) June 24 = Sun.
Aug. 21 = Tues.

1844 (9) May 31 = Fri.
Feb. 29 = Thurs.

* Knowledge and Scientific News.



WEGENER'S "PROFILE OF THE ATMOSPHERE."

The lowest dotted line (about 7 miles above the ground) is "where the air stops growing colder." It is the upper limit of ordinary clouds, of storms, and of balloon ascensions by human beings. Nearly all the moisture of the atmosphere lies below this level. Above this line comes the second layer of the atmosphere, the stratosphere (also called the "isothermal layer," because a thermometer carried up through it would show little change of temperature with change of elevation). This layer has been penetrated by sounding-balloons, carrying meteorological apparatus but no human aeronaut, as far as 20 miles above the earth. At about 50 miles—the upper limit of twilight—begins a region in which the atmosphere consists chiefly of hydrogen. Near the lower border of this region clouds of fine dust have sometimes been observed, shining by reflected sunlight on summer nights. These "noctilucent clouds" are commonly explained as the product of volcanic eruptions on the earth (they were frequently seen after the eruption of Krakatoa), but may be of cosmical origin.

Concerning the uppermost regions of the atmosphere we have little positive knowledge. Above about 130 miles from the earth, Dr. Alfred Wegener, the author of this diagram, believes that a gas ("geocoronium"), much lighter than hydrogen prevails, to which he attributes the characteristic green line in the spectrum of the higher auroras. This is hardly more than a guess at present.

CHAPTER III.

METEOROLOGY.*

By C. Fitzhugh Talman.

COMPOSITION, PRESSURE AND HEIGHT OF THE ATMOSPHERE.

Up to a height of eight or ten miles above the earth the composition of the atmosphere is remarkably uniform, as to its principal constituents. *Pure dry air* is a mixture (not a chemical compound) of gases in the following proportions, by volume: Nitrogen, 78.03%; oxygen, 20.99%; argon, 0.94%; carbon dioxide, 0.03%; hydrogen, 0.01%; together with minute quantities of neon, krypton, xenon, helium, and possibly other gases. At the levels habitable by man the air always contains invisible water vapor (from a small trace to about 5%), and usually small and variable amounts of ozone, ammonia, nitric acid, and other gases, which, on account of their irregular occurrence, are not classed among the normal constituents of the atmosphere. Lastly, the lower air always contains solid impurities, in endless variety, generically known as *dust*.

The *pressure of the air* at sea-level averages about 14.7 pounds to the square inch, which corresponds to a reading of 29.92 inches of the barometer. The density and the pressure of the air decrease rapidly as we ascend. At an altitude of 3.6 miles above sea-level they are reduced one-half; i. e., half the whole mass of the atmosphere lies below this elevation; yet the atmosphere extends at least 300 miles above the earth. At great altitudes the tenuity of the atmosphere is comparable to that of the best "vacuums" attainable in the laboratory.

THE UPPER ATMOSPHERE.

The investigation of the upper atmosphere, which has been prosecuted most actively since the beginning of the twentieth century, constitutes a special branch of research known as *aerology*. It has made meteorology a "science of three dimensions."

The atmosphere is "sounded" by means of meteorological instruments attached to kites and balloons. The greatest height ever attained by a kite was 4.51 miles above sea-level, at Mount Weather, Va., May 5, 1910; by a balloon, 20.14 miles, at Uccle, Belgium, June 9, 1911. Above the levels attainable by these means, the atmosphere is studied by observations of the aurora, meteor trains, and optical phenomena, and by computation of the distribution of the atmospheric gases, as determined by their atomic weights.

Since the year 1902 it has been known that the atmosphere is divided into at least two layers, or shells, having quite different properties. If we could travel in a balloon to the top of the atmosphere we should find the air rapidly growing colder as we ascended, until, at a height of about 7 miles, this fall in temperature suddenly ceased, as we entered the *isothermal layer*, or *stratosphere*. The air below this level—the *troposphere*—contains practically all the moisture of the atmosphere; hence all clouds (except possibly dust clouds of volcanic or cosmical origin). All storms, also, are confined to the troposphere.

During our ascent through the stratosphere we should find ourselves in a region of comparatively gentle winds and of uniform temperature in a vertical direction. We should find the atmosphere gradually ceasing to be "air," and becoming mainly nitrogen. Later we should reach a region in which nitrogen was replaced by the lighter gas hydrogen.

Possibly a gas even lighter than hydrogen exists in the atmosphere, and if so it must be most abundant at the highest levels. Its existence is conjectured on the evidence of the spectrum of a certain type of aurora,

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and it has been named provisionally "geocoronium."

Wegener's profile of the atmosphere represents these facts graphically.[1]

THE METEOROLOGICAL ELEMENTS AND INSTRUMENTS.

The *temperature of the air* is measured with the *thermometer*, or continuously with the *thermograph*. Extremes of temperature are automatically recorded with the *maximum* and the *minimum thermometer*. The temperature underground is measured with the *soil thermometer*.

The total *solar radiation* or *insolation* is measured with the *actinometer* or the *pyrheliometer*. The intensity of the shorter wave-lengths, including the ultra-violet, is measured with several forms of *photometer*. The distribution of energy throughout the solar spectrum is measured with Langley's *bolometer*. The *duration of sunshine* is measured with the *sunshine-recorder*.

The *pressure of the air* is measured with the *barometer* (mercurial or aneroid), or continuously with the *barograph*. Minute fluctuations of pressure are measured with the *statoscope*, the *microbarograph*, the *pressure-variometer*, or the *variograph*. Altitude, as affecting barometric pressure, is measured with the *hypsometer*.

The *humidity of the air* (relative or absolute) is measured with the *hygrometer* or the *psychrometer;* or continuously with the *hygrograph*.

The *rainfall* is measured with the *rain-gage*—probably the oldest of meteorological instruments. Rain-gages were used in India in the 4th century B.C. The *self-recording rain-gage* makes a continuous record of the amount of rainfall; the *ombroscope* of its duration only, including the lightest showers. *Snowfall* is usually measured as rainfall; i. e., the observer melts the snow before measuring it, or else computes its "water equivalent." There are, however, *snow-gages* of various forms. The *drosometer*, for measuring dew, is little used.

Evaporation is measured with the *atmometer* (*atmidometer, evaporimeter*); continuously with the *atmograph*.

The *direction of the wind* is observed with the *wind-vane*, which may be arranged to make a continuous record. The *velocity* or the *force of the wind* is measured with the *anemometer* (continuously with the *anemograph*), or estimated by the observer in terms of a simple wind-scale. (See Beaufort Scale at the end of the chapter.) The vertical component of the wind is measured with the *vertical anemometer*.

The *state of the weather*, as clear, partly cloudy, cloudy, raining, foggy, etc., is observed non-instrumentally. The *degree of cloudiness* is the number of tenths of the sky covered with clouds, from 0 = cloudless to 10 = completely overcast. Exact measurements of cloudiness may be made with Besson's *nephometer*. The duration of cloudiness at night is sometimes measured with the *pole-star recorder*.

Clouds are observed as to their form, and as to direction and speed of movement, as measured with the *nephoscope*. Photographic measurements of clouds are made with the *photonephograph*.

The normal electrical phenomena of the atmosphere include the *vertical potential gradient*, measured with *collectors* and *electrometers* (some self-recording); also *ionization* and its effects, observed with *dissipation-apparatus, conductivity-apparatus, ion-counters*, etc.

Lightning flashes set up Hertzian waves (known to wireless operators as "atmospherics," "strays," "statics," "X's," etc.) and these are recorded at a distance by the *ceraunograph*, or *thunderstorm-recorder*, or audibly in the *ceraunophone*.

Aerological observations, now forming part of the routine of many observatories, have been referred to in the preceding section. The apparatus employed includes the *kite* and the *kite-reel* (usually a power-driven winch); the *captive balloon*; the *pilot-balloon* (sent aloft without attached instruments, merely for observing the drift of the upper air, and usually followed with a theodolite); the *sounding-balloon* (which bursts at a great altitude, and is wafted gently to the ground, with its attached instruments, by a parachute

[1] Wegener's "geocoroniumsphere" is still a matter of speculation, but has attained considerable prominence in the current literature of meteorology. His "hydrogensphere" is, in current terminology, usually included in the stratosphere.

or an auxiliary balloon); the *inflating-balance*, for securing the proper ascensional force of balloons; and special light forms of *meteorograph*, which are attached to kites and balloons and continuously record the temperature, pressure, humidity, etc., during a flight.

Various accidental constituents of the atmosphere are measured at certain observatories; especially *ozone*, with the *ozonometer*, and *dust*, with the *dust-counter*, the *koniscope*, or the *aeroscope*.

The *periodical phenomena of animals and plants* form a most valuable gage of weather and climate. Their observation constitutes a borderland between meteorology and biology, known as *phenology*.

METEOROLOGICAL INSTRUMENTS. (Pages 488-497.)

I. Temperature and Radiation.

1. Maximum and minimum thermometers. 2. Thermograph. 3. Thermometer screen. 4. Earth thermometer (section). 5. "Black bulb in vacuo." 6. Pyrheliometer (Marvin). 7. Thermometric sunshine recorder (Marvin). 8. Photographic sunshine recorder (Jordan). 9. Burning-glass sunshine recorder (Campbell-Stokes). 10. Terrestrial radiation thermometer.

II. Atmospheric Pressure.

11. Mercurial barometer (Fortin type). 12. Aneroid barometer. 13. Statoscope. 14. Barograph. 15. Microbarograph (Shaw-Dines). 16. Pressure-variometer (Bestelmeyer).
Nos. 13 and 16 are for aeronautical use.

III. Humidity.

17. Aspiration psychrometer (Assmann). 18. Hair hygrometer. 19. Psychrometer. 20. Polymeter (Lambrecht). 21. Whirl psychrometer.

IV. Precipitation.

22. Tipping-bucket rain-gage. 23. Tube, density bucket, and scale for weighing samples of snow (Marvin). 24. Rain-gage and measuring-glass (Snowdon pattern). 25. Details of standard rain-gage (U. S. Weather Bureau). 26. Vertical snow scale (Marvin).

V. Evaporation.

27. Evaporation-pan and still-well (Marvin). 28. Evaporimeter (Piche). 29. Porous cup atmometer (Livingston). 30. Balance-evaporimeter (Wild). 31. Atmograph (Houdaille).

VI. Wind.

32 and 33. Pressure-tube anemometer (Dines). 34. Arrow wind-vane, Robinson anemometer, and support (U. S. Weather Bureau patterns). 35. (To the left) Lind's pressure-anemometer. (To the right) Windmill vane of the anemocinemograph (Richard). 36. Pressure-plate anemometer (Fuess). 37. Pendulum anemometer. 38. Recording dial of No. 36. 39. Photographic vertical anemometer (Ludewig). 40. Vertical anemometer (Wiechert).
Nos. 39 and 40 are chiefly of aeronautical use.

VII. Clouds.

41. Reflecting nephoscope (Fineman). 42. Nephometer (Besson). 43. Direct-vision nephoscope (Besson). 44. Reflecting nephoscope (Marvin).

VIII. Atmospheric Electricty.

45. Self-registering electrometer (Benndorf). 46. Dissipation apparatus (Elster & Geitel). 47. Conductivity apparatus (Gerdien). 48. Ceraunograph, or thunderstorm recorder, combined with a barograph (Turpain).

IX. Aerology.

49-52. Meteorographs for kites and balloons (49, German; 50, U. S.; 51, French; 52, English). 53. Balloon theodolite. 54. Inflating balance. 55. Meteorological kite.

X. Miscellaneous.

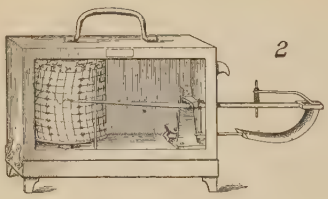
56. Meteorograph, or electrical recording apparatus for wind-vane, anemometer, rain-gage, and sunshine recorder (U. S. Weather Bureau pattern). 57. Dust-counter (Aitken). 58. Aeroscope (Miquel).

The foregoing list of the meteorological elements and instruments is by no means exhaustive.

HEATING AND COOLING OF THE ATMOSPHERE.

The amount of heat received by the atmosphere from the moon, the planets and the stars is infinitesimal, and these bodies have no influence whatever on terrestrial weather and climate. The atmosphere is very slightly warmed by the internal heat of the earth; its mean temperature is probably raised less than three-tenths of a degree Fahrenheit by this agency—a negligible amount.

1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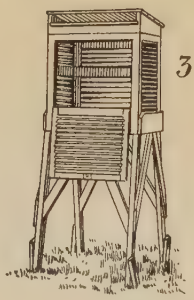
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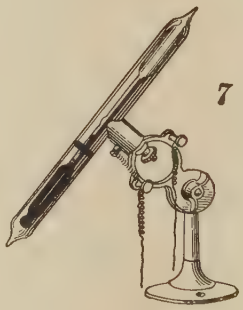
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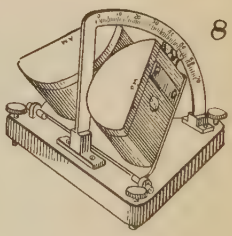
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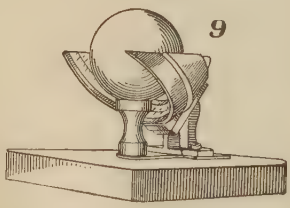
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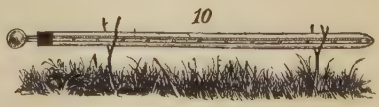
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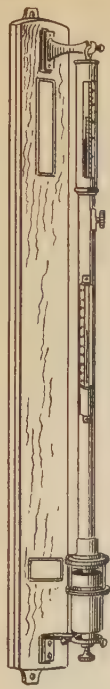
METEOROLOGICAL INSTRUMENTS. I. TEMPERATURE AND RADIATION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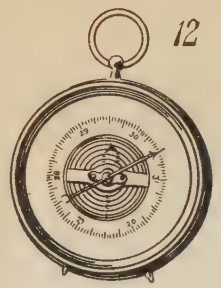
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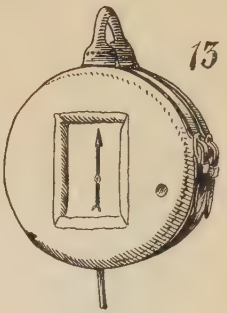
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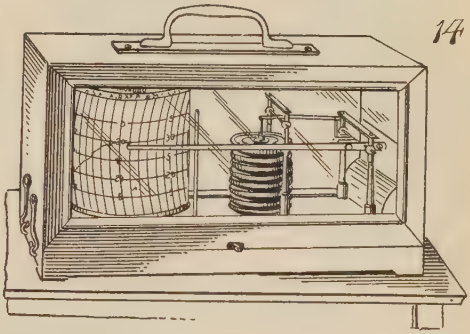
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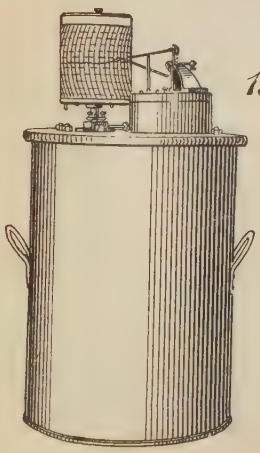
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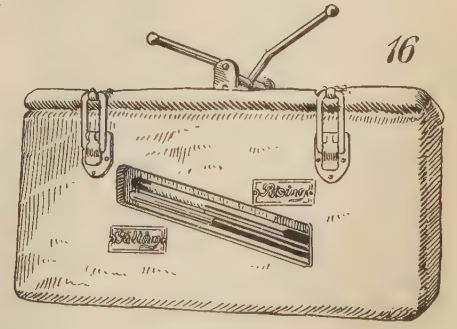
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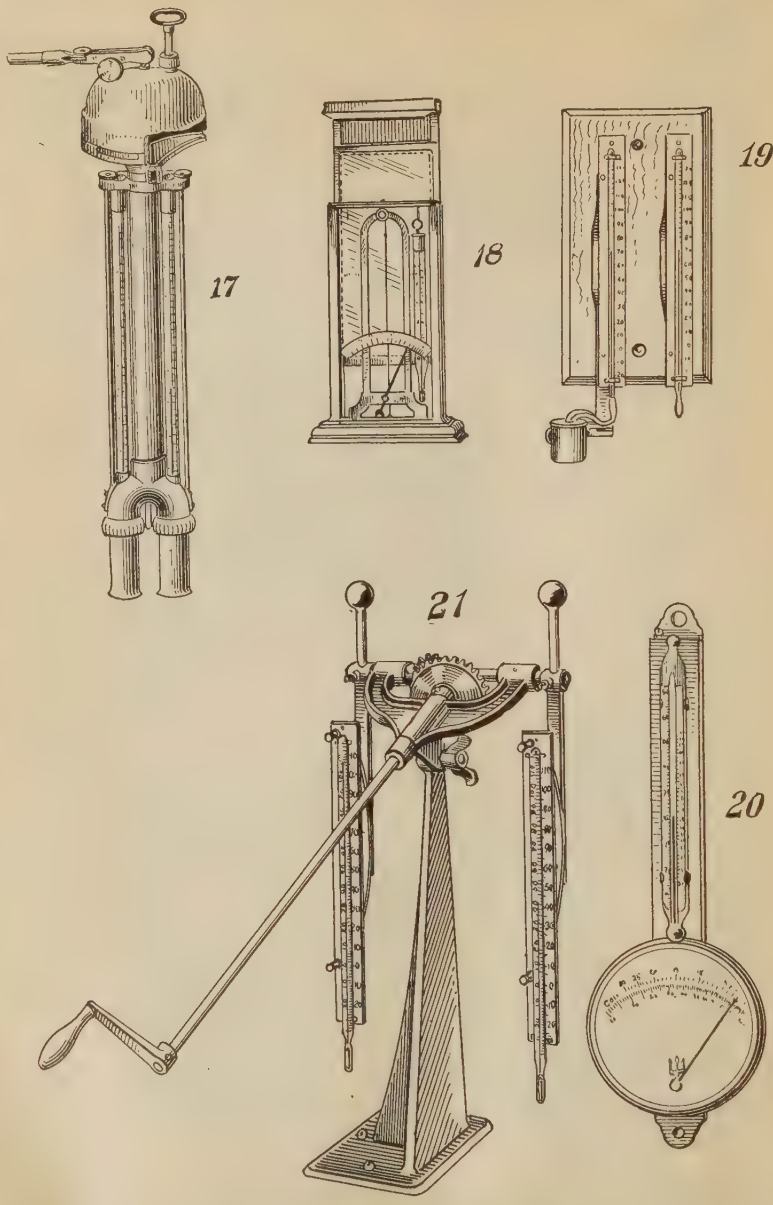
METEOROLOGICAL INSTRUMENTS. II. ATMOSPHERIC PRESSURE.



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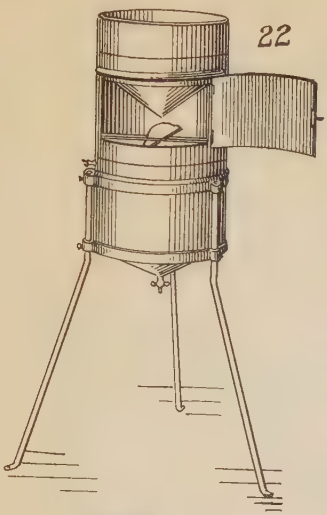

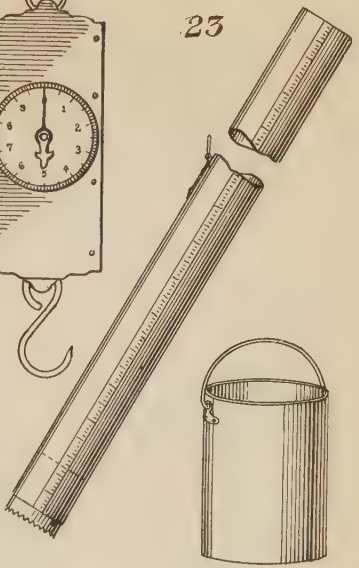

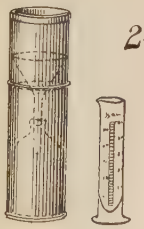

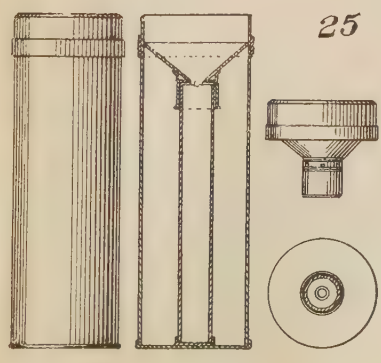

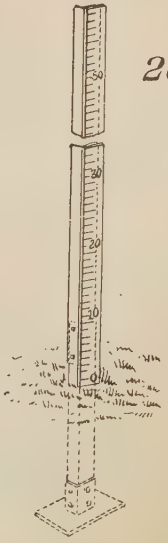

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METEOROLOGICAL INSTRUMENTS. IV. PRECIPITATION.

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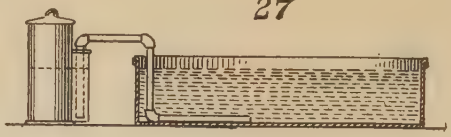

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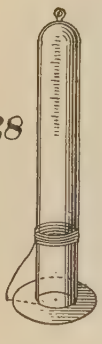

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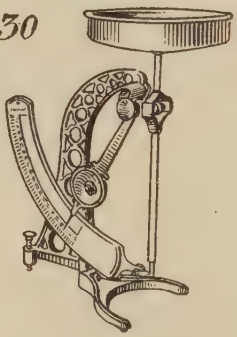

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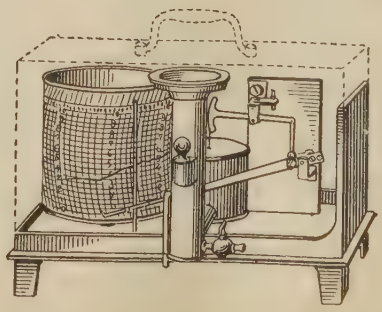

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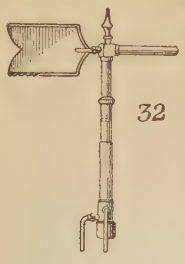

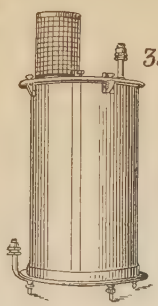

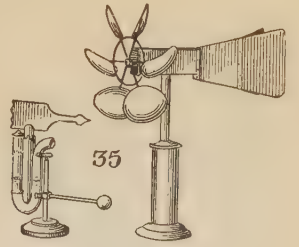

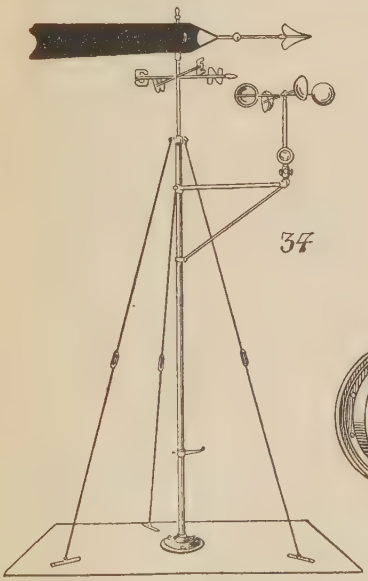

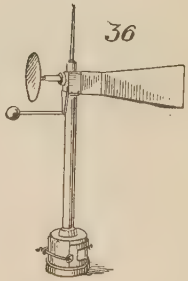

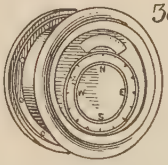

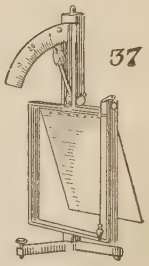

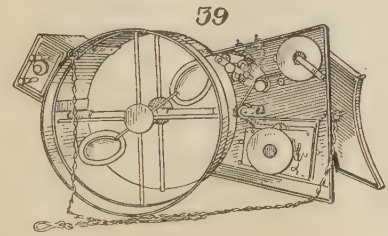

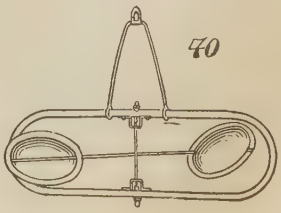

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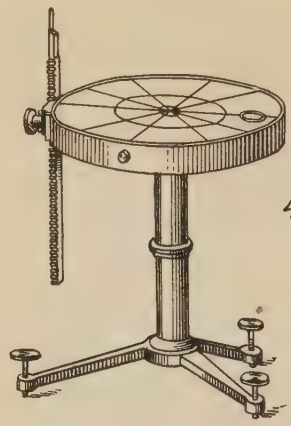
METEOROLOGICAL INSTRUMENTS. VI. WIND.



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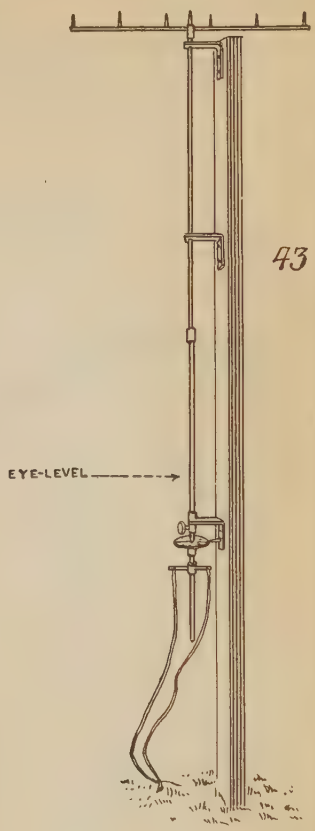

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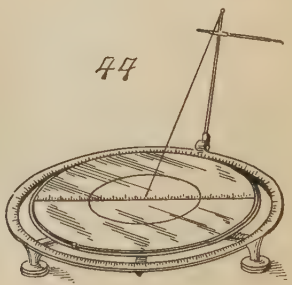

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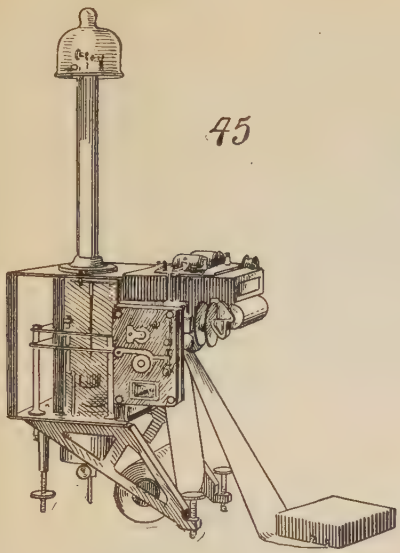
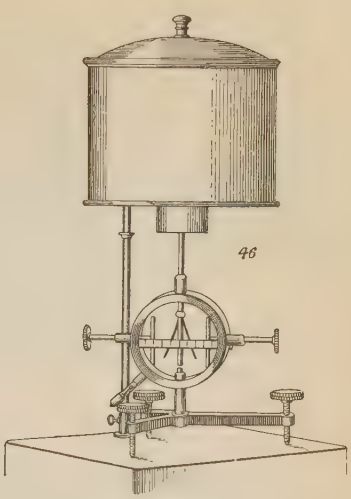
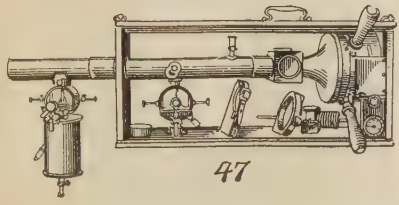
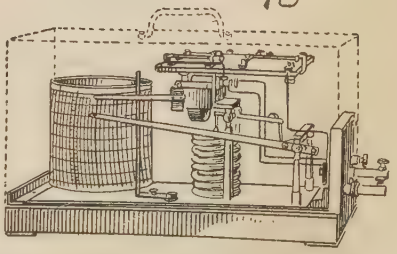
METEOROLOGICAL INSTRUMENTS. VII. CLOUDS.









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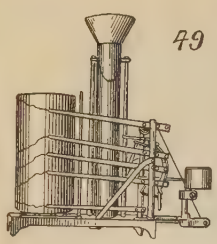
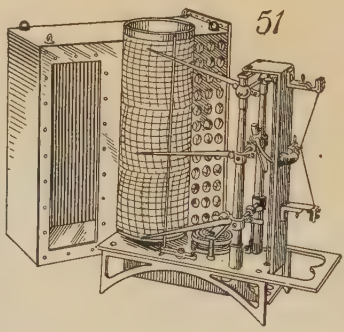
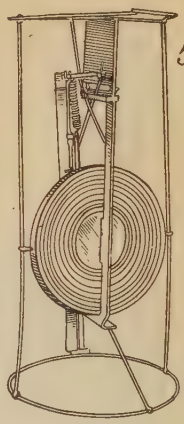
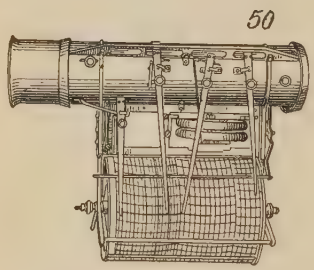
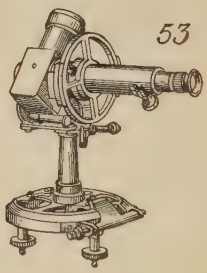
METEOROLOGICAL INSTRUMENTS. VIII. ATMOSPHERIC ELECTRICITY.

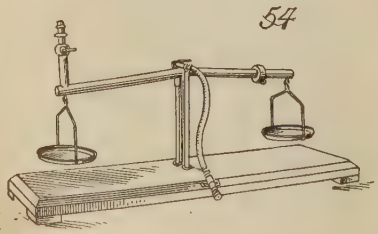


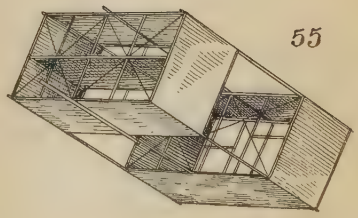












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METEOROLOGICAL INSTRUMENTS. IX. AEROLOGY.

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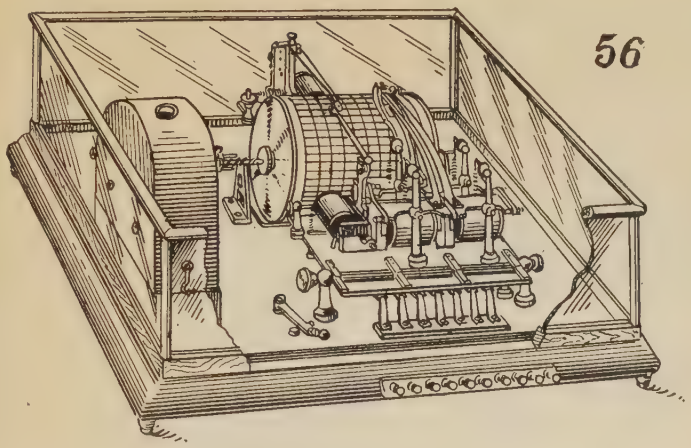

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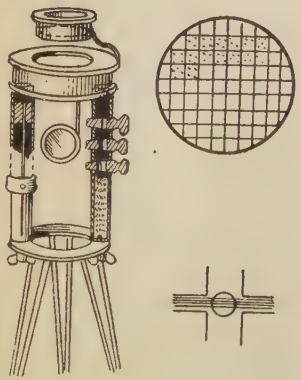

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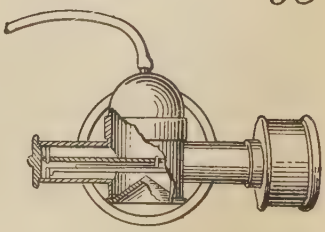

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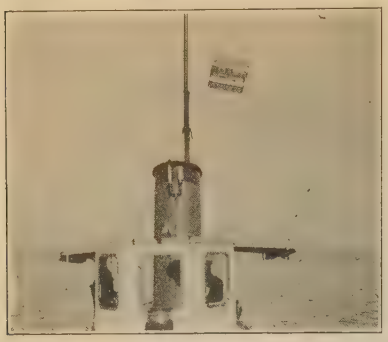
METEOROLOGICAL INSTRUMENTS. X. MISCELLANEOUS.



KITE FLYING FROM A MOVING BOAT ON LAKE CONSTANCE.

The *sun* is the one great source from which the atmosphere is heated. At its outer limit the atmosphere receives vertically from the sun, on an average, 1.92 calories of heat per square centimeter per minute (Abbot, Proc. Amer. Phil. Soc., 1911). This datum is known as the *solar constant* —a misnomer, as the actual amount fluctuates by several per cent; i. e., the sun is not actually a constant source of heat.

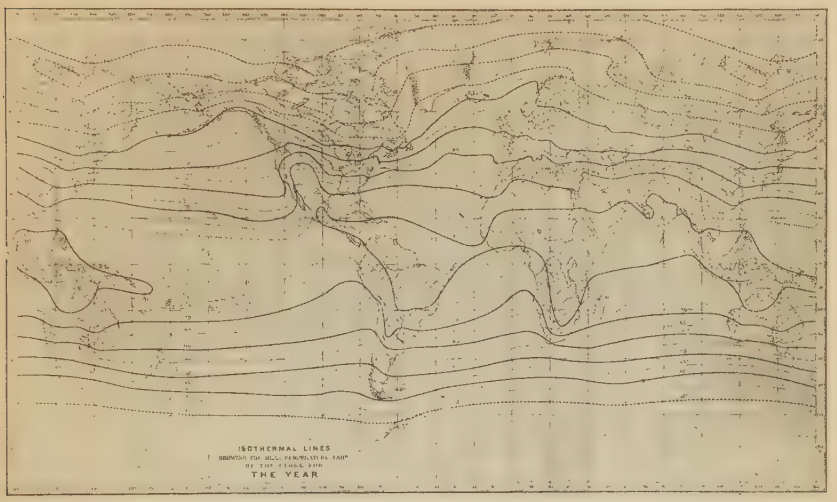
The atmosphere is mainly heated from below, although the heat originally comes from above. This paradox is explained by the fact that but a small part of the solar heat is absorbed by the atmosphere when passing through it on its way to the earth. Several processes are involved in the disposal of solar heat (more accurately, radiation) by the earth and its atmosphere, and different wave-lengths undergo different effects. This complex subject, involving the study of solar radiation with the aid of the pyrheliometer, bolometer, photometer, polarimeter, etc., forms a border science between meteorology and solar physics, with important applications to biology. It is engaging the attention of a numerous body of investigators, but has not yet received a distinct name.

For the present purpose it may be stated that the earth, heated by the sun's rays, imparts its heat by conduction to a shallow layer of air immediately above it. Conversely, portions of the earth's surface withdrawn from the sun's rays lose their heat by radiation into space, and the air adjacent to them is cooled by conduction. Inequalities of temperature plus the force of gravity set up air currents, which distribute heat through the atmosphere. The latter process is called *convection*. As between a land surface and a water surface, the former undergoes much wider fluctuations of temperature from day to night, and from summer to winter, causing correspondingly wider fluctuations in the temperature of the overlying atmosphere. Hence a continental climate is much less equable than a marine climate. Lastly, rising and falling air-masses are *adiabatically* cooled and heated, respectively, at the rate of 1.6° Fahrenheit per 300 feet of vertical motion. (The cooling process is less rapid than this when condensation of moisture is in progress.)

DISTRIBUTION OF TEMPERATURE.

The earth revolves around the sun, and its axis, which always remains parallel to itself, is inclined to the plane of its orbit. These facts explain the march of the seasons and their opposition in the two hemispheres. The amount of heat (insolation) received at any place at a given moment depends chiefly upon the altitude of the sun. The aggregate amount received at any period of the year depends also upon the length of the day, which varies with latitude, except at the equinoxes. At the summer solstice, the north pole, where the day is then 24 hours long, actually receives a greater daily amount of insolation than any other part of the globe; but this is ineffective in raising the temperature on account of the long oblique path of the solar rays through the atmosphere, and the large amount of snow and ice that must be melted before the overlying air can be warmed. At the winter solstice a still greater amount of insolation is received at the south pole, as the earth is then in perihelion.

If the earth had a smooth homogeneous surface and no atmosphere the horizontal distribution of temperature at any time would depend entirely upon latitude. The theoretical climate resulting from such conditions is called *solar climate*. Actually, however, this simple distribution is profoundly modified by the thickness of the layer of air through which the sun's rays pass (depending upon the sun's altitude), the different thermal properties of land and water, the presence or absence of snow and ice, the configuration of the earth's



ANNUAL ISOTHERMS OF THE GLOBE (BUCHAN.)

surface, the prevailing winds, the distribution of water vapor, etc.

How widely the actual distribution of temperature differs from that of the solar climate may be seen from an annual isothermal chart of the globe. An *isotherm* is a line on such a chart drawn through places having the same temperature. The first isotherms of the mean annual temperature of the whole world were drawn by Humboldt in 1817, and introduced into meteorology the valuable idea of the *isogram*—i. e., a line on a chart connecting places at which equality of some physical condition exists. An isogram of barometric pressure is called an *isobar;* of rainfall, an *isohyet;* of cloudiness, an *isoneph;* of duration of sunshine, an *isohel;* etc. Upwards of eighty meteorological isograms have been given special names.[2]

The lowest temperatures on the earth occur in winter in the northeastern part of Siberia, the somewhat indefinite center of greatest cold being known as the "cold pole." At Verkhoyansk, in this region, a temperature of 90.4° below zero Fahrenheit was recorded on Jan. 15, 1885—the lowest ever reported at a regular meteorological station. The highest temperatures occur in the deserts of both the temperate and the torrid zones. At Wargla (French *Ouargla*), in the Algerian Sahara, a temperature of 127.4° Fahrenheit was recorded on July 17, 1879. Much higher temperatures have been reported—as high as 167° in the desert of Gobi—but the records in these cases are not entirely trustworthy. Of course these are all shade temperatures.

In the upper atmosphere the lowest temperatures occur at great heights over the equatorial regions, where the troposphere is thicker than in higher latitudes, and hence the ordinary fall of temperature with ascent proceeds to a greater height before the isothermal layer is reached. The lowest temperature ever registered by a sounding-balloon was 119° below zero Fahrenheit, over Victoria Nyanza, in the heart of Africa.

GENERAL CIRCULATION OF THE ATMOSPHERE.

In the equatorial regions the surface air is heated more than elsewhere, and tends to rise and overflow at high levels, toward the poles; while the relatively cold air of the polar regions tends to flow equatorward, near the earth's surface, to replace it. A simple circulation between the equator and

[2] See "The Meteorological Isograms," Scientific American Supplement, Nov. 12, 1910.

the poles could, however, only occur if the earth did not rotate on its axis.

The deflective force of the earth's rotation causes a particle of air moving in any direction over the earth's surface to deviate to the right in the northern hemisphere and to the left in the southern.

At about latitude 30° the winds coming from the equator have been so much deflected that they move almost due eastwardly. The result is a great whirl around the pole, occupying most of the temperate zone in each hemisphere, with prevailing winds from west to east at all levels. The centrifugal force of this whirl causes the air to bank up at about latitude 30°, producing a belt of high pressure in that region, which is known as the *horse latitudes*. Between this belt and the equator there is a regular circulation of air equatorward below (the *trade winds*) and poleward above (the *antitrades*); both systems being given an oblique direction by the earth's rotation. Near the equator, between the two trade wind systems, is a region of calms or variable winds, with abundant clouds and rains, known as the *doldrums*. Trades and doldrums shift north and south in the course of the year, following the sun, and give to regions which come alternately under their control successive dry and rainy seasons.

The prevailing westerly winds of middle latitudes are stronger in the southern hemisphere, where they blow mainly over the ocean and are little impeded by friction, than in the northern hemisphere; hence the violence of the winds known to mariners as the "brave west winds" in the region called the "roaring forties" (about 40° south latitude).

Within the polar circles the low temperatures increase the density of the air, which flows radially away from the poles near the earth's surface; an effect that appears to be reenforced by the drainage of air down the glacier slopes of the two polar continents (Greenland and Antarctica).

From north to south the main wind systems of the globe run in the following sequence:

1. Arctic calms and outflowing winds, deflected westwardly (with poleward winds overhead).
2. Westerly (i. e., eastwardly) winds of middle latitudes.
3. Horse latitudes ("calms of Cancer").
4. Northeast trade winds (with southwest antitrades overhead).
5. Doldrums or equatorial calms (with east winds overhead).
6. Southeast trade winds (with northwest antitrades overhead).
7. Horse latitudes ("calms of Capricorn").
8. Westerly (i. e., eastwardly) winds of middle latitudes.
9. Antarctic calms and outflowing winds, deflected westwardly (with poleward winds overhead).

These prevailing wind systems are, however, greatly disturbed by the periodic winds due to the different thermal effects of land and water surfaces; by the surface configuration of the land; and, in middle latitudes, by the continual passage of cyclonic and anticyclonic areas.

PERIODIC WINDS.

Comparing day and night, summer and winter, the land is alternately warmer and colder than the ocean. Hence there is an annual seesaw of the winds on a vast scale between land and sea (the *monsoons*), and a daily seesaw on a smaller scale between coasts and the adjacent waters (*land and sea breezes; land and lake breezes*).

Another class of alternating winds occurs in valleys, where warm air flows up the slopes by day, and cold air drains downward by night (*mountain and valley breezes*). This phenomenon has always strongly impressed the popular imagination; and scores of winds of this class have been given individual local names. Such are the *pontias*, *vésine* and *solore* of the French Alps; the *joran* of Lake Geneva; the *breva* and the *tivano* of Lake Como, etc.

CYCLONES AND RELATED PHENOMENA.

A *cyclone, barometric depression*, or *low* is a system of winds blowing around a center of low barometric pressure. Near the earth's surface the wind is drawn spirally inward toward the center of the system, the direction of rotation being always counterclockwise in the northern hemisphere and clockwise in the southern. Hence we have *Buys Ballot's law*: Stand with your back to the wind and the barometer will be lowest on your left hand in the northern hemisphere, and on your right hand in the southern. The

air drawn into the vortex of the system rises and tends to flow spirally outward, though its actual direction is much modified by the prevailing drift of the atmosphere (west-east in middle latitudes). Besides its rotary motion, the cyclone as a whole has usually a more or less rapid translatory motion. The two motions may be compared with those of the earth, which rotates on its axis and at the same time revolves in its orbit around the sun.

Extratropical cyclones, which are responsible for the very changeable weather of the temperate zones, cover hundreds or thousands of square miles and have a translatory movement averaging 600 or 700 miles a day, usually in an eastwardly direction. They appear to be carried around the globe in the general circumpolar whirl described above. They are typically accompanied by cloudy weather, with rain or snow and rising temperature on their east and equatorward sides: and by clearing weather, with falling temperature, on their west and poleward sides.

The term *anticyclone*, or *high*, is somewhat loosely applied to any region of high barometric pressure. The typical anticyclone has a system of winds just the reverse of that found in the cyclone, outflowing below and inflowing above; and such a system is commonly assumed to be characterized by clear, cool and settled weather. In fact, however, all kinds of weather occur in anticyclones, which appear to be essentially somewhat inert masses of air which are not partaking of the circulation going on around them.

The *tropical cyclone* (*hurricane* of the West Indies; *typhoon* of the China Sea; *baguio* of the Philippines), is a relatively violent whirl, which originates in the stagnant air of the doldrums, and usually moves in an oblique and curved path toward higher latitudes, sometimes passing into the temperate zone and becoming an extratropical cyclone. These disturbances (which are always "storms," while extratropical cyclones frequently are not) are confined to certain relatively small regions of the globe, and to certain seasons. West India hurricanes are most common from July to October (the "hurricane season"). They frequently cause frightful devastation in the Caribbean Sea and the Gulf of Mexico, and on the southeastern coasts of the United States (as at Galveston, Sept. 8, 1900, when 6,000 lives and $30,000,000 in property were destroyed). The amount of shipping exposed to these storms will be much increased with the opening of the Panama Canal. Their movements are now closely watched by the U. S. Weather Bureau, which maintains observing stations in the West Indies during the hurricane season, and receives regular wireless weather reports from vessels plying in that region.

The *spout* is a vortex in the atmosphere, usually not over a few hundred feet in diameter, which begins in the upper air and is propagated downward. Its position is marked by a funnel-shaped cloud. Spouts are distinguished, according to their place of occurrence, as *landspouts* and *waterspouts*, and the more violent landspouts are called *tornadoes*. The tornado is popularly miscalled a "cyclone." These disturbances appear to be secondary phenomena of the true cyclone, and (in the northern hemisphere) occur chiefly in a region southeast of the cyclone center.

Thunderstorms are sometimes scattered phenomena, of local origin, and sometimes occur in a long line extending radially from center to border of a cyclone. In the latter case they constitute a *line-squall*. Their winds tend to rotate about a horizontal axis. Their electrical phenomena are probably the result, not the cause, of the atmospheric movements.

A wind blowing from a warm region toward a cyclonic center is called a *sirocco*, and its attendant weather is often called, in the United States, a *warm wave*. Winds blowing in winter from a cold region toward such a center bring us *cold waves*, or *blizzards* (the latter term implying the presence of driving snow as well as a low temperature).

A wind of cyclonic origin blowing down a mountain slope constitutes a *fallwind*. Such a wind, dried by the precipitation of its moisture on the windward slope, and further dried and heated by compression in its descent, is called a *foehn* (*chinook* in the northwestern United States); its effects are most striking in winter, when it sometimes raises the temperature on the lee side of the mountains 30° or 40° in a few minutes, causing the snow to disappear with astonishing rapidity. The *bora* of the Adriatic and the *mistral* of the French Riviera

differ from the foehn in the fact that they blow from a cold mountainous interior to a warm coastland, and therefore, though heated in their descent, produce the impression of a cold wind.

MOISTURE IN THE ATMOSPHERE.

For any temperature of the air there is a maximum amount of moisture that can be present in an invisible form (water vapor); when the air is charged to the limit it is said to be "saturated." *Absolute humidity* is the weight of water vapor present, per unit volume, or the tension of this vapor; *relative humidity*, the ratio of the amount present to the amount necessary for saturation, expressed in percentage. Cooling of saturated air causes condensation, in the form of cloud, fog, mist, rain, snow, hail, dew, or hoarfrost. The temperature at which condensation occurs is called the *dew-point*.

The cooling of the air leading to the formation of *clouds* occurs in a variety of ways. One of the most common is the *adiabatic* cooling of a body of air rising and expanding under diminished pressure. The upper clouds, cirrus, cirro-stratus, cirro-cumulus, consist of ice crystals; all others of water drops, though the latter often occur when the temperature is far below the freezing point, the water being "supercooled."

THE INTERNATIONAL CLASSIFICATION OF CLOUDS.

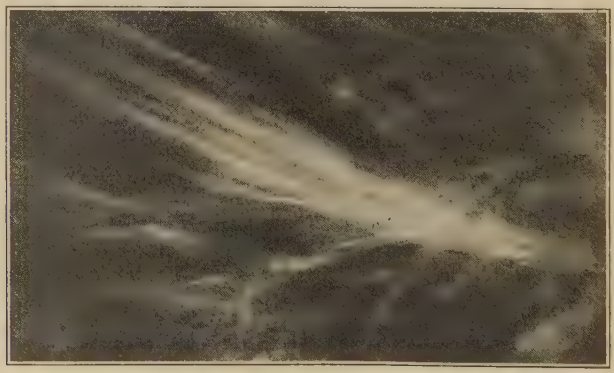
[Nearly all classifications of clouds are based upon that of Luke Howard, published in 1803. Howard defined seven types of cloud, which he named *cirrus, cumulus, stratus, cirro-cumulus, cirro-stratus, cumulo-stratus,* and *cumulo-cirro-stratus* or *nimbus.*

A score or more of other classifications, some of them very elaborate, have since been introduced; but the International Classification, illustrated herewith, is the only one now in general use.

The photographs numbered 1, 2, 5, 8 and 9 are from Loisel's "Atlas photographique des Nuages"; all the others are by Commander D. Wilson-Barker, R.N.R.

A cloud at the earth's surface constitutes *mist* or *fog* (nearly synonymous terms, the latter being usually preferable for technical use). *Haze* is a turbid state of the atmosphere; sometimes purely optical, sometimes mechanical. In the latter case it is often due to the presence of dust and smoke, rather than moisture, and is then called *dry fog* or *dust haze.*

Moisture deposited from the atmosphere upon the earth is called *precipitation.* In the cold season this usually takes the form of *snow;* i. e., tiny ice crystals, in a great variety of



1. Cirrus—Detached clouds of delicate or fibrous appearance often showing a featherlike structure, generally of a white color. Occasionally cirrus clouds are arranged in parallel belts which cross a portion of the sky in great circles, and by an effect of perspective appear to converge towards a point on the horizon, or if sufficiently extended towards the opposite point also. (Cirro-stratus and Cirro-cumulus are also sometimes arranged in similar bands.)

2. Cirro-Stratus.—A thin whitish sheet of cloud, sometimes covering the sky completely and giving it a milky appearance (it is then called cirro-nebula), at other times presenting more or less distinctly a formation like a tangled web. This sheet often produces halos around the sun or moon.

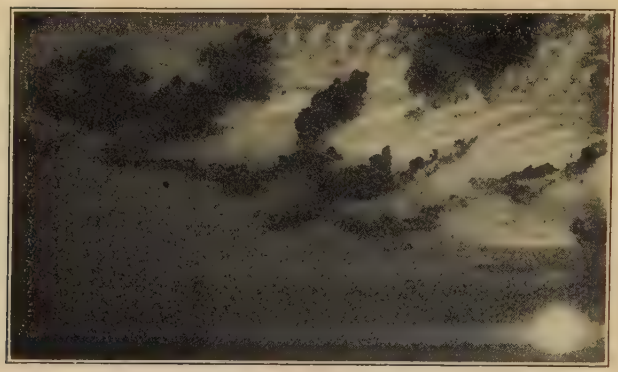
3. Cirro-Cumulus (Mackerel Sky).—Small globular masses or white flakes without shadows, or showing very slight shadows, arranged in groups and often in lines.

shapes; in the warm season, of *rain*.

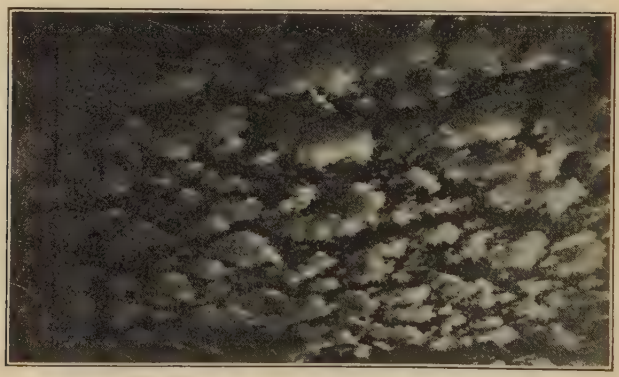
Hail, properly so called, falls chiefly in summer thundershowers. It consists of ice and compact snow, often in concentric layers. The destruction wrought by hail throughout the world averages at least $200,000,000 a year. Many expedients have been tried to avert hailstorms; e. g., the discharge of cannon, bombs, and rockets at the clouds, and the erection of paragrêles, or "hail rods" (essentially lightning rods); but the resulting benefits are entirely illusory. The term *soft hail* is applied to little pellets of snow that fall in spring; *winter hail*, or *sleet*, to pellets of clear ice that fall in winter.

Fog drifting against terrestrial objects in cold weather leaves a rough deposit of ice known as *rime*. Rain, in cold weather, may coat such objects with a smooth sheet of ice, known as *glazed frost*. Sometimes this deposit is so heavy as to break down the branches of trees, telegraph wires, etc., constituting an *ice storm*.

Moisture condensed directly upon



4. Alto-Stratus.—A thick sheet of a grey or bluish color, sometimes forming a compact mass of dark grey color and fibrous structure. At other times the sheet is thin, resembling thick cirro-stratus, and through it the sun or the moon may be seen dimly gleaming as through ground glass. (In this picture patches of cumulus are seen in the foreground.)



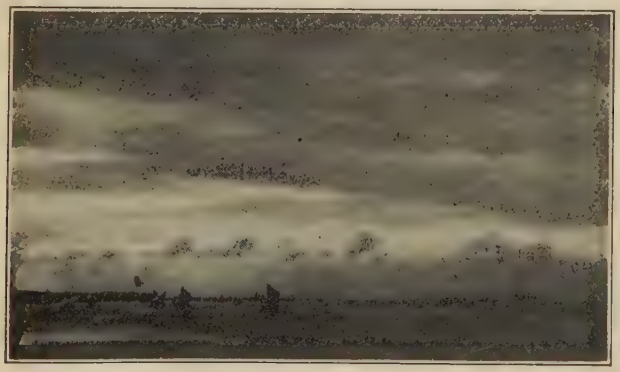
5. Alto-Cumulus.—Largish globular masses, white or greyish, partially shaded, arranged in groups or lines, and often so closely packed that their edges appear confused.

objects that have been cooled by nocturnal radiation is called *dew* when liquid, *hoarfrost* when frozen.

Rainfall, as an element of climate, includes all forms of aqueous precipitation (the frozen forms being expressed in their water equivalent). Measurements of rainfall refer to the depth of water that would lie upon the ground if none of it ran off, soaked in, or evaporated. Annual rainfalls may be classified, especially with reference to agriculture, as excessive when over 75 inches; copious, 50-75 inches; moderate, 25-50 inches; light, 10-25 inches; desert, under 10 inches.

The heaviest rainfall occurs within or near the tropics. The rainiest meteorological station in the world is Cherrapunji, India, with an annual mean of 457.80 inches. Remarkable showers include one of 101.84 inches in four days, June 12-15, 1876, at Cherrapunji; and one of 135 inches in eight days in November, 1909, at Silver Hill, Jamaica (of this amount

6. Strato-Cumulus.—Large globular masses or rolls of dark clouds, frequently covering the whole sky, especially in winter. Generally it presents the appearance of a grey layer irregularly broken up into masses of which the edge is often formed of smaller masses, often of wavy appearance. Sometimes this cloud form presents the characteristic appearance of great rolls arranged in parallel lines and pressed close up to one another (roll-cumulus).



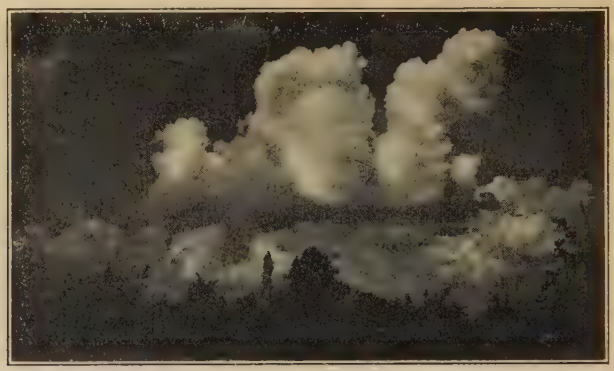
7. Nimbus.—A thick layer of dark clouds, without shape and with ragged edges from which steady rain or snow usually falls. Through the openings in these clouds an upper layer of cirro-stratus or alto-stratus may be seen almost invariably. If a layer of nimbus separates up in a strong wind into shreds, or if small loose clouds are visible floating underneath a large nimbus, they may be described as *fracto-nimbus* ("scud," of sailors).

114.50 inches fell in five days). The heaviest mean annual rainfall in the United States (not including Alaska) is about 136 inches in Tillamook County, Oregon.

No part of the world is absolutely rainless, though there are parts of the Sahara and other deserts in which whole years go by without a drop of rain.

ATMOSPHERIC ELECTRICITY.

The surface of the earth has normally a charge of negative electricity; hence, with respect to the earth, any point in the atmosphere has normally a positive potential. The *potential gradient* of the atmosphere at any time and place is the difference of potential per meter of vertical distance. It is subject to a simple yearly and a less



8. Cumulus (Wool-pack Cloud).—Thick cloud of which the upper surface is dome-shaped and exhibits protuberances while the base is horizontal. These clouds appear to be formed by a diurnal ascensional movement which is almost always noticeable. True cumulus has well defined upper and lower limits. In strong winds a broken cloud resembling cumulus is often seen in which detached portions undergo continual changes. This form is distinguished by the name *fracto-cumulus.*

9. Cumulo-Nimbus (Thunder Cloud).—Heavy masses of cloud rising in the form of mountains or turrets or anvils generally surmounted by a sheet or screen of fibrous appearance (false cirrus), and having at its base a mass similar to nimbus. From the base local showers of rain or of snow (occasionally of hail or soft hail) usually fall. Sometimes the upper edges assume the compact form of cumulus, and form massive peaks round which the delicate "false cirrus" floats. At other times the edges themselves separate into a fringe of filaments similar to cirrus clouds.

simple daily variation. In disturbed weather, especially during thunderstorms, it fluctuates widely and rapidly, frequently changing its sign.

The *ionization of the atmosphere*, together with its effects and possible causes, forms one of the important new branches of meteorological research. Owing to the presence of ions in the atmosphere, an electrically charged body loses its charge by conduction to the surrounding air. This process, known as *dissipation*, is affected by various meteorological conditions.

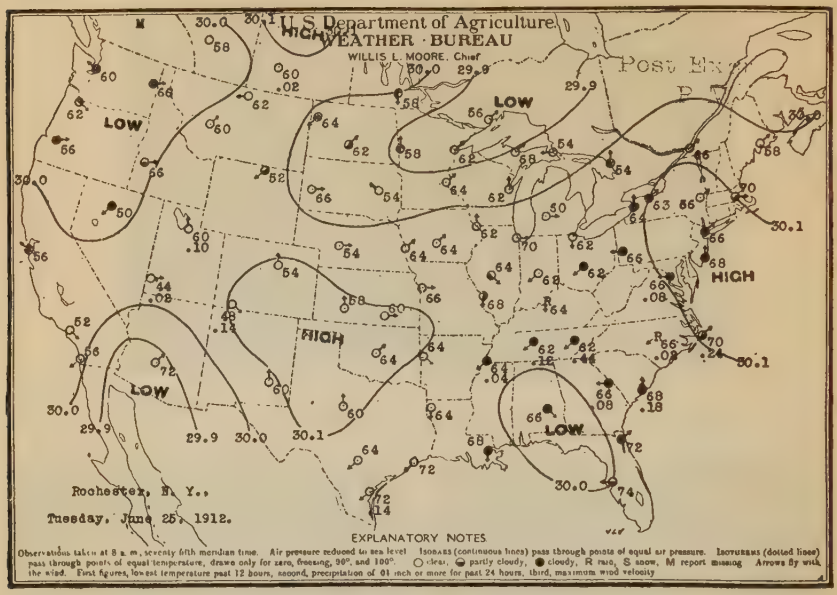
An excessive difference of potential between a point in the atmosphere and the earth, or between two points in

10. Stratus.—A uniform layer of cloud which resembles a fog but does not rest on the ground. If the cloud layer is broken up into irregular shreds in a wind or by mountains, it may be distinguished by the name *fracto-stratus.*

(a) (b)

Lightning flashes photographed with (*a*) stationary camera, and (*b*) moving camera. (Dr. B. Walter, Hamburg).

the atmosphere, may result in a disruptive discharge along a narrow path, known as *lightning;* or, more specifically, *linear lightning,* from which is distinguished the more gentle diffuse discharge known as *sheet lightning.* Apparent sheet lightning is often merely the reflection on the clouds of distant linear lightning; it is then distinguished as *heat lightning. St. Elmo's fire* (also called by a score of other names) is a brush



NEWSPAPER WEATHER MAP

discharge from the points of terrestrial objects, and is most common on mountain summits. *Ball lightning*, which takes the form of a ball of fire moving slowly through the air, has never been satisfactorily explained.

Photographs made with a camera turning on a vertical axis have proved that linear lightning often consists of several discharges in rapid succession along an identical path in the atmosphere.

An apparently broad stream of lightning is called *ribbon lightning*. *Beaded* or *pearl lightning* assumes the appearance of a string of brilliant beads. It is very rare. Still rarer is *rocket lightning*, which shoots up into the air at the apparent speed of a skyrocket.

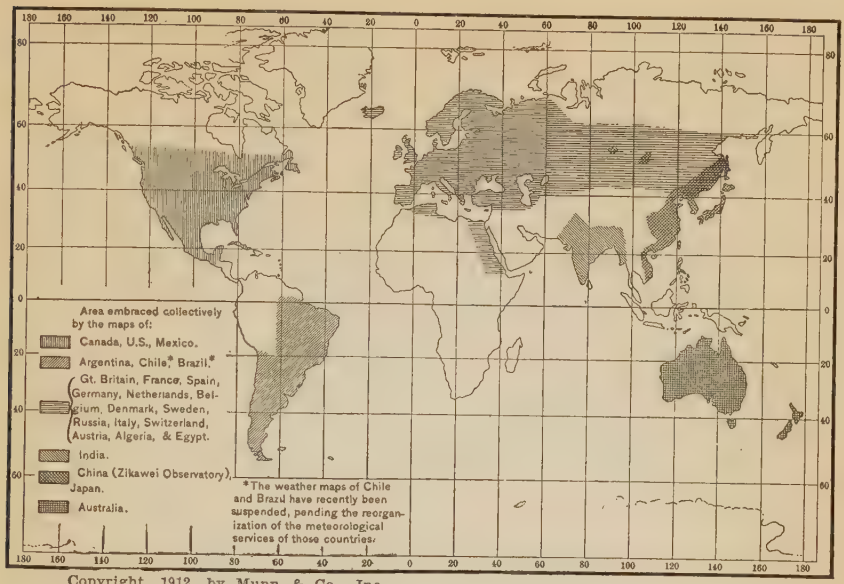
The utility of *lightning-rods* has often been questioned. The consensus of scientific opinion is that they are very useful if properly constructed; otherwise they are worse than useless.

The *aurora polaris* is now most commonly attributed to the passage of cathode rays through the atmosphere, under the effects of some kind of radiation or emission from the sun. Its variations are generally synchronous with those of solar activity and terrestrial magnetism. The aurora is best studied by means of simultaneous photographs from two stations, and with the spectroscope. There appear to be two principal forms; (1) the tranquil, homogeneous arc (part of a great circumpolar ring), occurring only at great altitudes; and (2) shifting beams and draperies, occurring mainly at lower levels. There is some evidence that a feeble auroral glow commonly extends over the whole nocturnal sky, in all latitudes (*earth-light*).

ATMOSPHERIC OPTICS.

The optical phenomena of the atmosphere (*photometeors*) include astronomical refraction, the colors of the sky, twilight phenomena, polarization of skylight, scintillation, mirage, the transparency of the atmosphere, and various luminous appearances, including rainbows, coronas, glories and halos.

The *rainbow* is due to the refraction and reflection of light in water drops (usually raindrops). *Primary*


Area embraced collectively by the maps of:
Canada, U.S., Mexico.
Argentina, Chile,* Brazil.*
Gt. Britain, France, Spain, Germany, Netherlands, Belgium, Denmark, Sweden, Russia, Italy, Switzerland, Austria, Algeria, & Egypt.
India.
China (Zikawei Observatory), Japan.
Australia.
*The weather maps of Chile and Brazil have recently been suspended, pending the reorganization of the meteorological services of those countries.

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LAND AREAS EMBRACED IN THE PUBLISHED DAILY WEATHER MAPS OF THE WORLD.

and *secondary bows* (often bordered with *supernumerary* or *spurious bows*) are seen opposite the sun; the higher the sun, the lower the system of bows, and vice versa. Bows of higher order (tertiary, quaternary, etc.) are of theoretical interest only; they are rarely, if ever, seen. The reflected image of the sun in a sheet of water may give rise to *intersecting rainbows*. Lunar rainbows are sometimes seen; they are, as a rule, nearly colorless, owing to feeble illumination.

The *corona* is a small ring, or series of rings, of prismatic colors, surrounding the sun or moon; it is due to the diffraction of light by water drops, ice crystals or dust. Fine dust in the atmosphere (as after the eruption of Krakatoa) gives rise to a large corona known as *Bishop's ring*.

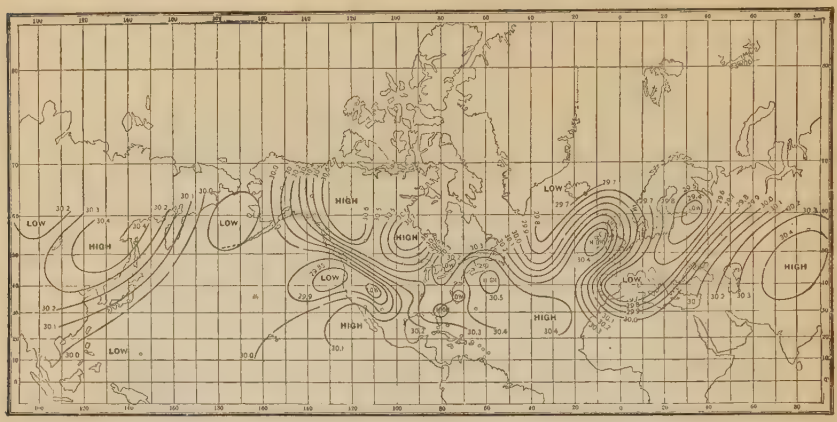
From a mountain top or other elevation a person sometimes sees his shadow cast on a bank of fog or cloud. (The shadow seems "gigantic" owing to overestimation of its distance.) The head is often surrounded by a *glory* of colored light, due to diffraction. The whole phenomenon is called the *spectre of the Brocken*. Very striking examples are seen from balloons.

Halos are due to the refraction or reflection (or both) of light by ice crystals in the atmosphere. These may take the form of rings of definite angular size (the commonest has a radius of 22°) surrounding the sun or moon; also of rings or arcs in various other positions, and discs of light (*parhelia*, or *paraselenæ*; in popular language, "sundogs" or moondogs"). Some halos are distinctly colored, others are not. Complete descriptions and discussions of halo phenomena, scores of which have been classified, are found only in certain French and German works.[8]

CLIMATE.

Climate is often defined as average weather; and climatic statistics refer mainly to average conditions. It would be better, however, to define it as "the sum total of weather,"

[8]On the descriptive side the best account is L. Besson's "Les différentes formes de halo et leur observation," published in *L'Astronomie*, Paris, March-May, 1911.



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Daily synoptic weather chart of the Northern Hemisphere. (Chart of Jan. 13, 1911.) It is prepared daily, in manuscript, at Washington from telegraphic reports, but is not published. The curved lines are isobars, or lines of equal barometric pressure.

since occasional departures from the average, in the shape of hot and cold waves, droughts and excessive rain, severe storms, etc., aid in giving character to the climate of the places where they occur.

Climatology is the science of climate in general; *climatography* is devoted to the description of particular climates.

That "the climate has changed" within a generation or so is a stubborn popular delusion, which prevails all over the world, and has probably prevailed in every age. It arises from the fact that exceptional weather impresses itself more lastingly upon the memory than normal weather.

METEOROLOGICAL SERVICES AND THEIR WORK; WEATHER PREDICTION.

The central organization is the International Meteorological Committee, which meets triennially; president, Dr. W. N. Shaw, director of the British Meteorological Office, London; secretary, Dr. G. Hellmann, director of the Royal Prussian Meteorological Institute, Berlin. Under this committee are several international "commissions" on special subjects. Occasionally an International Meteorological Conference is held, comprising the directors of all meteorological services.

Practically every civilized country has an official weather service; some have more than one. These services issue weather maps and weather forecasts, and compile climatic statistics. The national weather service of the United States is the Weather Bureau of the Department of Agriculture, with headquarters in Washington; its chief is Prof. Willis L. Moore.

A weather service consists of a central station or observatory, and a "réseau" of subordinate stations scattered over the country. The stations are of two principal classes: (1) *Telegraphic stations*, at which meteorological observations are made simultaneously at fixed hours (in the United States, 8 a. m. and 8 p. m., eastern standard time), and immediately telegraphed to headquarters, where they are charted to form the *weather map* which is the basis of the *weather forecast*. (2) *Climatological stations*, largely manned by volunteer observers. Their reports are sent in by post,

BEAUFORT WIND SCALE.

		Equivalent velocity		o miles per hour.
0	Calm			
1	Light Air	"	"	1-3 "
2	Light Breeze	"	"	4-7 "
3	Gentle "	"	"	8-12 "
4	Moderate "	"	"	13-18 "
5	Fresh "	"	"	19-24 "
6	Strong "	"	"	25-31 "
7	High Wind (Moderate Gale)	"	"	32-38 "
8	Gale	"	"	39-46 "
9	Strong Gale	"	"	47-54 "
10	Whole "	"	"	55-63 "
11	Storm	"	"	64-75 "
12	Hurricane	"	"	above 75 "

and are utilized especially in compiling climatic statistics. Certain countries, including the United States, receive reports from observers on shipboard, and compile meteorological statistics for the oceans. Many marine observers now send reports by wireless telegraphy.

The cardinal principle of forecasting from the weather map is the fact that the weather depends mainly upon the movement of cyclones and anticyclones. The distribution of weather in these systems has been described above. Broadly speaking, the weather, in the temperate zones, moves from west to east.

The prediction of ordinary weather changes, from day to day, is the least successful and the least important part of forecasting. On the other hand, such phenomena as severe storms, cold waves, heavy snowfall disastrous night frosts, and other occurrences of far-reaching importance are predicted with great accuracy.

The latest development of weather forecasting in the United States is the *daily weather map of the northern hemisphere.* It has proved the importance of certain quasi-permanent areas of high and low pressure (for example, the great "high" that prevails over Siberia in winter) in determining the movements of the subordinate "highs" and "lows" that directly control the weather.

River stage prediction has reached a high degree of accuracy, especially in the United States, where numerous river-gages and rainfall stations are maintained in every important river basin, and it is possible to predict the stage of a river, at a given point, from three or four days to three weeks in advance, within a limit of error of a few inches.

METEOROLOGY AND AERONAUTICS.

Meteorological investigations have received a great impetus through the development of aeronautics. The requirements of this art have given a practical *raison d'être* to the world-wide campaign of upper air, or free air, research that has been carried on by meteorologists since the beginning of the present century.

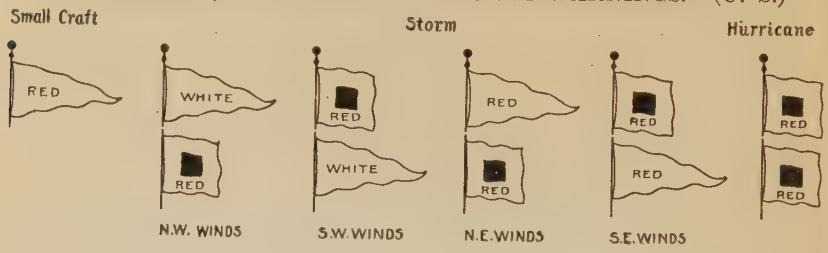
In the year 1911 was published the first general textbook of *aeronautical meteorology* (by Linke), a practical science that aims to do for the aeronaut what marine meteorology and hydrography combined do for the mariner.

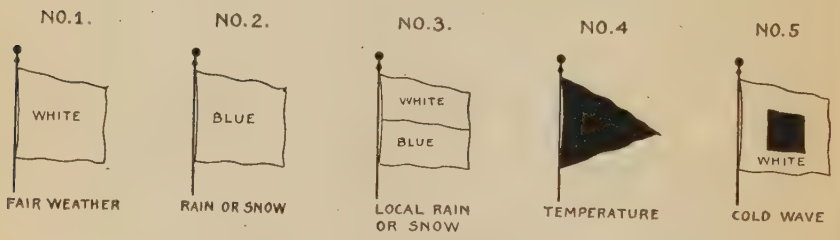
Special weather predictions for aeronauts have been undertaken experimentally in Germany; where an "aeronautical weather bureau" has its headquarters at Lindenberg and a network of telegraphic reporting stations throughout the country at which daily observations of the upper air currents are made with pilot balloons.

SENDING UP A PILOT BALLOON

to determine the speed and direction of the air currents at various levels. The movement of the balloon is observed with a theodolite.

SMALL CRAFT, STORM AND HURRICANE WARNINGS. (U. S.)





EXPLANATION OF WEATHER FLAGS. (U. S.)

EXPLANATION OF SMALL CRAFT, STORM AND HURRICANE WARNINGS.

Small craft warning.—A red pennant indicates that moderate winds are expected.

Storm warning.—A red flag with a black center indicates that a storm of marked violence is expected.

The pennants displayed with the flags indicate the direction of the wind: white, westerly (from southwest to north); red, easterly (from northeast to south). The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

By night a red light indicates easterly winds, and a white light below a red light, westerly winds

Hurricane warning.—Two red flags with black centers, displayed one above the other, indicate the expected approach of a tropical hurricane, or one of those extremely severe and dangerous storms which occasionally move across the Lakes and northern Atlantic coast.

No night small craft or hurricane warnings are displayed.

INTERPRETATION OF DISPLAYS

No. 1, alone, indicates fair weather, stationary temperature.

No. 2, alone, indicates rain or snow, stationary temperature.

No. 3, alone, indicates local rain or snow, stationary temperature.

No. 1, with No. 4 above it, indicates fair weather, warmer.

No. 1, with No. 4 below it, indicates fair weather, colder.

No. 2, with No. 4 above it, indicates rain or snow, warmer.

No. 2, with No. 4 below it, indicates rain or snow, colder.

No. 3, with No. 4 above it, indicates local rain or snow, warmer.

No. 3, with No. 4 below it, indicates local rain or snow, colder.

INTERNATIONAL STORM SIGNALS.

For a gale commencing with wind in the NW. quadrant.

For a gale commencing with wind in the SW. quadrant.

For a gale commencing with wind in the NE. quadrant.

For a gale commencing with wind in the SE. quadrant.

For a hurricane.

MEAN TEMPERATURE F° AND MEAN ANNUAL PRECIPITATION.

Name of Place.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Years Record	Precip. (in ins.)	Years.
Algiers	53.4	55.4	57.6	61.0	65.8	71.4	77.0	77.5	74.8	68.5	62.4	55.6	22	30.12	(67)
Athens	47.5	48.9	53.4	59.5	68.0	75.9	81.1	80.4	74.3	66.9	57.4	50.9	46	15.35	(47)
Auckland	66.6	67.3	65.7	61.3	57.0	53.8	52.0	52.0	54.5	57.0	59.0	64.2	15	43.73	(45)
Bergen	34.2	33.6	35.4	42.1	48.9	55.0	57.9	57.6	52.7	45.1	38.5	34.7	50	77.09	(54)
Bombay	74.5	74.8	78.1	82.0	84.6	82.4	79.5	79.3	79.3	80.8	79.3	76.5	..	74.02	(..)
Brussels	34.3	36.1	39.7	46.9	53.2	59.7	63.0	62.2	57.7	49.5	41.2	35.6	50	28.78	(58)
Cairo, Egypt	54.1	56.8	62.4	70.2	76.8	81.9	83.5	82.6	78.1	71.4	65.1	57.9	35	1.26	(20)
Calcutta	65.1	70.3	79.3	84.9	85.6	84.6	82.9	82.4	82.6	80.1	72.3	65.3	..	60.79	(72)
Chicago, Ill	23.7	25.4	34.4	45.9	56.5	66.3	72.4	71.2	64.6	53.2	39.2	29.3	33	33.29	(35)
Christiania	24.1	23.9	29.5	39.9	50.9	59.9	62.6	60.6	52.7	41.9	32.2	25.5	50	22.95	(25)
Christchurch, N. Z	61.7	60.8	58.5	53.1	48.4	45.0	42.4	43.9	48.6	52.7	56.3	60.8	15	25.24	(21)
Colombo, Ceylon	79.0	79.7	80.6	81.5	82.0	80.4	80.1	80.4	80.4	79.3	79.5	79.2	..	88.27	(..)
Constantinople	41.4	41.4	46.2	53.4	62.4	70.3	74.3	74.5	68.4	62.2	53.2	45.7	47	28.86	(48)
Dunedin, N. Z	57.7	57.4	55.4	51.4	47.3	44.1	42.4	44.1	46.8	50.7	53.2	56.3	15	34.56	(32)
Florence	40.8	43.9	48.9	56.1	63.1	70.7	76.1	74.8	68.5	58.8	49.3	42.6	39	35.00	(73)
Geneva	32.0	33.6	40.8	48.9	55.9	62.8	67.1	64.9	59.2	49.1	40.8	33.6	37	33.82	(37)
Jerusalem	44.6	47.5	51.4	58.8	66.9	70.3	73.2	73.4	70.3	66.4	55.9	48.9	14	26.02	(48)
Khartoum	71.4	75.6	80.4	84.7	92.1	91.8	88.3	87.3	88.5	88.2	82.0	74.8	6½	5.16	(9)
Lisbon	49.3	52.0	54.1	56.5	60.8	66.4	70.4	70.2	68.0	61.5	56.1	50.7	20	28.58	(95)
London	38.1	39.7	42.1	48.0	53.8	60.3	63.1	62.1	57.6	49.8	43.0	39.2	..	25.47	(40)
Madras	75.4	76.6	79.5	84.2	88.7	88.3	85.6	84.6	83.8	80.8	77.9	75.7	..	48.84	(..)
Madrid	39.7	43.9	47.5	52.3	59.4	68.5	75.7	74.8	66.4	54.9	47.1	40.1	20	16.50	(30)
Malaga	53.6	55.4	57.6	61.5	65.7	71.4	76.8	77.2	72.5	66.0	60.3	55.4	20	23.90	(8)
Malta	53.4	53.4	55.0	58.6	63.9	70.9	76.5	77.2	74.1	68.9	61.7	55.8	48	20.35	(19)
Melbourne	67.5	67.3	64.6	59.7	54.0	50.0	48.7	51.1	54.0	57.6	61.2	64.6	51	25.47	(51)
Milan	32.4	38.1	46.0	55.2	62.6	70.0	74.8	73.0	66.0	55.6	44.1	35.6	50	39.65	(151)
Naples	46.8	48.4	51.4	56.8	63.7	70.3	75.6	75.0	69.8	63.1	54.7	48.7	50	32.76	(84)
New Orleans, La	53.0	56.3	62.0	67.9	74.5	79.6	81.3	81.0	78.0	69.5	60.6	54.4	33	57.42	(35)
New York	30.2	30.7	37.5	48.1	59.3	68.5	73.5	72.2	66.5	55.6	44.0	34.4	33	44.63	(35)
Nice	46.4	47.5	50.7	56.6	62.2	69.1	73.8	73.2	68.2	61.0	52.7	47.3	50	33.74	(16)
Paris	36.5	39.0	43.2	50.5	56.1	62.4	65.5	64.4	59.0	50.5	42.8	37.2	50	21.93	(30)
Rangoon	74.7	77.4	81.1	84.9	82.2	79.5	78.8	78.6	79.2	80.1	78.3	75.6	..	98.82	(..)
Rome	44.1	46.6	50.7	56.5	64.0	71.2	76.6	75.7	70.2	61.7	52.3	45.9	50	31.61	(80)
San Francisco	49.5	51.3	52.7	53.7	55.5	57.0	57.3	58.0	59.3	58.4	55.5	50.9	33	22.27	(35)
Sydney	71.4	71.1	69.3	64.6	58.5	54.3	52.3	54.9	58.8	63.5	66.9	70.0	46	48.35	(49)
Venice	36.5	40.6	46.6	55.8	63.5	71.4	76.3	74.7	68.0	58.5	47.1	39.6	50	29.53	(69)
Vienna	28.9	32.4	39.0	48.9	57.2	63.9	67.3	65.8	59.4	49.6	38.3	30.9	50	24.53	(56)
Wellington, N. Z	62.4	62.2	61.0	57.4	52.9	49.6	47.5	48.6	51.1	54.0	56.8	60.8	15	50.63	(40)

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Prepared by United States Weather Bureau especially for this book.

LOWEST TEMPERATURE: RECORD TO DECEMBER 31, 1910, BY MONTHS, AT SPECIFIED STATIONS.

[Source: The Weather Bureau, Department of Agriculture.]

Station.	Number of years record.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Lowest record.
		°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
Abilene, Tex.	24	− 5	− 6	17	25	33	48	55	55	40	30	13	1	− 6
Albany, N. Y.	36	−24	−18	− 8	13	29	40	48	45	32	23	−10	−17	−24
Amarillo, Tex.	18	− 6	−16	− 2	22	26	42	51	49	36	23	4	− 1	−16
Atlanta, Ga.	31	− 2	− 8	8	25	38	39	58	55	43	30	16	1	− 8
Bismarck, N. Dak.	35	−44	−43	−36	− 3	13	31	32	32	10	− 2	−28	−38	−44
Boise, Idaho	31	−28	−12	5	17	26	30	40	32	28	16	−10	− 7	−28
Boston, Mass.	39	−13	−11	− 8	11	31	42	46	47	34	25	− 2	−12	−13
Buffalo, N. Y.	37	−14	−13	− 4	11	28	39	47	44	35	24	2	− 9	−14
Charlotte, N. C.	31	1	− 5	14	26	37	45	55	53	38	28	18	− 5	− 5
Chicago, Ill.	37	−20	−21	−12	17	27	40	50	47	32	14	− 2	−23	−23
Cleveland, Ohio.	37	−17	−16	− 4	15	28	38	46	46	36	24	0	−12	−17
Denver, Colo.	37	−29	−22	−11	4	19	36	42	40	21	1	−18	−25	−29
Des Moines, Iowa	31	−30	−26	− 8	11	26	37	48	40	26	14	−10	−20	−30
Dodge, Kans.	35	−20	−26	− 9	13	19	40	46	45	30	10	−13	−15	−26
Dubuque, Iowa	36	−32	−31	−12	14	26	39	40	41	24	15	−12	−24	−32
Duluth, Minn.	37	−41	−36	−26	3	16	33	44	40	28	8	−29	−34	−41
Eastport, Me.	36	−20	−20	− 8	2	28	30	45	44	30	23	−13	−21	−21
El Paso, Tex.	31	5	5	21	29	40	49	56	52	42	26	11	− 5	− 5
Fresno, Cal.	22	20	24	28	34	38	42	50	51	42	36	27	23	20
Galveston, Tex.	38	11	8	30	43	52	57	66	68	54	44	29	18	8
Green Bay, Wis.	23	−36	−33	−23	11	26	34	43	40	25	8	−12	−21	−36
Harrisburg, Pa.	21	− 5	−13	5	22	34	43	50	49	36	28	11	4	−13
Havre, Mont.	18	−43	−48	−41	−11	15	31	31	27	18	− 7	−33	−43	−48
Helena, Mont.	29	−42	−41	−20	6	22	31	36	29	20	3	−22	−40	−42
Huron, S. Dak.	28	−43	−37	−25	7	20	31	41	33	18	3	−28	−34	−43
Indianapolis, Ind.	36	−25	−18	0	19	31	39	48	46	30	22	− 5	−15	−25
Jacksonville, Fla.	38	15	10	26	34	46	54	66	64	49	40	26	14	10
Jupiter, Fla.	22	24	27	33	39	53	64	68	68	61	48	36	24	24
Kansas City, Mo.	21	−17	−22	2	22	27	48	54	46	35	26	4	−13	−22
Knoxville, Tenn.	39	−16	−10	5	24	34	42	52	50	35	25	12	− 5	−16
Lander, Wyo.	18	−36	−35	−24	2	13	26	34	23	7	2	−31	−30	−36
Little Rock, Ark.	30	− 5	−12	16	28	39	51	60	52	41	31	10	6	−12
Los Angeles, Cal.	32	30	28	31	36	40	46	49	49	44	40	42	30	28
Louisville, Ky.	37	−20	−14	3	21	33	43	54	50	36	26	4	− 7	−20
Lynchburg, Va.	36	− 6	− 3	14	25	34	45	53	47	35	27	13	− 5	− 6
Montgomery, Ala.	37	5	− 5	21	30	35	48	61	58	45	31	21	8	− 5
New Orleans, La.	39	15	7	30	38	52	58	66	63	55	40	29	20	7
New York, N. Y.	38	− 6	− 6	3	20	34	45	50	51	36	31	7	− 6	− 6
Northfield, Vt.	22	−32	−35	−18	− 1	18	30	34	31	23	12	−14	−27	−35
North Platte, Nebr.	35	−35	−35	−21	12	19	33	42	36	21	9	−25	−30	−35
Oklahoma, Okla.	19	−11	−17	9	22	33	48	56	49	36	27	9	− 2	−17
Omaha, Nebr.	37	−32	−26	− 7	6	25	42	50	44	30	15	−14	−17	−32
Oswego, N. Y.	39	−23	−18	−11	13	27	39	45	44	35	24	− 1	−18	−23
Palestine, Tex.	28	0	− 6	20	36	39	48	60	54	43	31	20	8	− 6
Parkersburg, W. Va.	21	−11	−27	4	20	31	42	48	45	33	20	15	− 5	−27
Phoenix, Ariz.	27	12	19	24	30	35	33	46	49	39	34	24	18	12
Port Huron, Mich.	35	−15	−25	−14	7	26	35	42	41	30	19	− 6	−14	−25
Portland, Oreg.	36	− 2	7	20	28	32	39	43	43	35	31	11	3	− 2
Rapid City, S. Dak.	22	−37	−40	−17	− 2	19	35	37	39	23	10	− 9	−25	−40
Red Bluff, Cal.	32	18	22	26	30	37	44	53	52	45	32	26	25	18
St. Louis, Mo.	39	−22	−18	3	22	32	44	55	52	37	24	5	−17	−22
St. Paul, Minn.	37	−41	−33	−22	7	23	36	45	40	28	12	−24	−39	−41
Salt Lake City, Utah.	35	−20	−13	0	18	25	33	43	44	29	22	− 2	−10	−20
San Antonio, Tex.	32	6	4	21	35	44	53	58	57	46	36	21	10	4
San Francisco, Cal.	38	29	33	33	40	43	46	47	47	47	45	38	34	29
Santa Fe, N. Mex.	36	−13	−11	0	11	20	33	43	40	21	13	−11	−13	−13
Sault Ste. Marie, Mich.	21	−28	−37	−27	3	21	32	40	37	28	16	− 7	−19	−28
Seattle, Wash.	16	11	12	20	32	36	42	48	46	36	31	15	25	11
Shreveport, La.	36	1	− 5	22	32	42	53	62	54	44	31	18	10	− 5
Spokane, Wash.	28	−30	−25	−10	22	29	34	41	38	26	12	−13	−18	−30
Springfield, Ill.	30	−22	−24	2	19	32	40	49	48	31	20	2	−14	−24
Springfield, Mo.	22	−17	−29	3	22	30	46	53	44	35	21	6	−11	−29
Tampa, Fla.	19	23	22	32	38	53	64	65	66	54	44	32	19	19
Vicksburg, Miss.	37	3	− 1	24	31	43	52	62	54	42	34	22	12	− 1
Walla Walla, Wash.	24	−17	−15	2	29	35	40	45	41	36	24	− 9	− 2	−17
Washington, D. C.	39	−14	−15	4	22	33	43	52	49	36	26	12	−13	−15
Williston, N. Dak.	31	−49	−49	−35	− 4	14	30	36	32	13	− 3	−29	−46	−49
Wilmington, N. C.	39	9	5	20	28	38	51	58	56	42	32	20	10	5
Winnemucca, Nev.	30	−28	−22	− 3	12	17	29	33	26	16	10	− 9	−20	−28

HIGHEST TEMPERATURE: RECORD TO DECEMBER 31, 1910, BY MONTHS, AT SPECIFIED STATIONS.

[Source: The Weather Bureau, Department of Agriculture.]

Station.	Number of years record.	January.	February.	March.	April	May.	June.	July.	August.	September.	October.	November.	December.	Highest record.
		°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
Abilene, Tex.	24	83	92	95	99	105	110	110	105	104	94	88	83	110
Albany, N. Y.	36	64	63	79	88	93	99	100	98	97	90	71	66	100
Amarillo, Tex.	18	80	84	96	90	98	105	100	102	101	94	83	75	105
Atlanta, Ga.	31	75	78	87	89	94	98	100	98	97	91	82	73	100
Bismarck, N. Dak.	35	60	64	81	90	96	103	107	105	102	91	73	64	107
Boise, Idaho	31	62	67	77	92	100	105	111	106	100	91	72	62	111
Boston, Mass.	39	70	64	78	85	97	98	101	97	102	90	76	67	102
Buffalo, N. Y.	37	70	67	79	84	88	93	95	94	95	86	70	64	95
Charlotte, N. C.	31	77	79	91	94	97	102	102	100	99	92	80	76	102
Chicago, Ill.	37	65	63	81	88	94	98	103	98	98	87	75	68	103
Cleveland, Ohio.	37	71	72	83	87	92	96	97	99	98	87	74	68	99
Denver, Colo.	37	76	77	82	86	92	99	102	105	97	90	77	74	105
Des Moines, Iowa.	31	64	70	88	92	94	101	109	103	99	91	76	69	109
Dodge, Kans.	35	74	83	98	95	101	106	108	105	101	94	84	79	108
Dubuque, Iowa.	36	63	67	86	88	94	99	106	100	97	89	74	67	106
Duluth, Minn.	37	51	58	70	82	91	97	99	95	94	80	73	54	99
Eastport, Me.	36	54	52	57	72	85	88	93	90	89	83	64	54	93
El Paso, Tex.	31	77	86	93	98	105	113	112	110	104	94	85	77	113
Fresno, Cal.	22	71	83	87	101	110	112	115	113	111	100	84	74	115
Galveston, Tex.	38	75	76	85	85	91	97	98	98	94	91	85	77	98
Green Bay, Wis.	23	51	59	82	84	91	100	100	98	95	84	69	51	100
Harrisburg, Pa.	21	67	74	83	92	95	97	101	98	95	88	75	66	101
Havre, Mont.	18	61	63	77	94	92	108	103	106	93	88	75	63	108
Helena, Mont.	29	63	65	72	86	89	102	103	98	91	84	71	46	103
Huron, S. Dak.	28	64	68	85	94	96	99	108	108	106	94	77	65	108
Indianapolis, Ind.	36	70	72	84	87	96	100	106	101	98	89	76	68	106
Jacksonville, Fla.	38	81	86	91	92	98	100	104	101	98	92	86	81	104
Jupiter, Fla.	22	83	87	89	90	93	95	96	96	93	94	87	86	96
Kansas City, Mo.	21	70	76	90	95	91	100	106	103	101	91	80	70	106
Knoxville, Tenn.	39	76	79	87	90	94	99	100	100	99	94	80	75	100
Lander, Wyo.	18	59	64	71	82	86	95	99	96	90	82	72	57	99
Little Rock, Ark.	30	78	79	87	94	94	102	106	105	101	93	84	78	106
Los Angeles, Cal.	32	87	88	99	100	103	105	109	106	108	102	96	89	109
Louisville, Ky.	37	74	78	88	91	94	100	107	105	102	91	79	74	107
Lynchburg, Va.	36	77	75	92	95	97	98	102	100	99	92	81	73	102
Montgomery, Ala.	37	79	83	90	92	98	106	107	103	99	96	85	79	107
New Orleans, La.	39	82	82	86	89	94	98	102	100	96	94	85	83	102
New York, N. Y.	38	67	69	78	90	95	97	99	96	100	88	74	68	100
Northfield, Vt.	22	61	59	75	85	90	95	95	92	90	83	70	61	95
North Platte, Nebr.	35	70	74	86	95	97	102	107	103	101	94	81	72	107
Oklahoma, Okla.	19	79	90	90	95	94	101	104	108	102	97	86	75	108
Omaha, Nebr.	37	63	78	91	94	97	100	106	105	102	92	80	71	106
Oswego, N. Y.	39	69	61	78	85	94	98	100	98	93	84	75	66	100
Palestine, Tex.	28	81	83	88	92	93	100	103	108	104	97	87	81	108
Parkersburg, W. Va.	21	74	76	86	93	94	99	102	98	99	90	78	72	102
Phoenix, Ariz.	27	87	92	97	105	114	119	117	116	114	105	97	95	119
Port Huron, Mich.	35	64	60	77	84	93	97	99	99	97	87	69	65	99
Portland, Oreg.	36	62	68	79	90	99	99	102	97	93	83	73	65	102
Rapid City, S. Dak.	22	69	72	85	90	92	103	106	106	102	96	79	75	106
Red Bluff, Cal.	32	77	82	86	96	110	110	115	114	108	97	88	76	115
St. Louis, Mo.	39	74	78	90	91	94	102	107	106	102	91	82	74	107
St. Paul, Minn.	37	51	61	83	87	94	98	104	100	96	87	74	58	104
Salt Lake City, Utah.	35	57	68	77	85	93	101	102	101	93	88	74	61	102
San Antonio, Tex.	32	83	90	97	99	104	105	106	108	103	99	89	86	108
San Francisco, Cal.	38	78	80	80	88	97	100	98	92	101	94	83	72	101
Santa Fe, N. Mex.	36	76	75	82	84	89	92	96	97	90	85	77	65	97
Sault Ste. Marie, Mich.	21	46	46	64	77	89	93	94	90	91	80	67	48	94
Seattle, Wash.	16	61	67	75	85	90	96	95	92	87	81	68	62	96
Shreveport, La.	36	80	81	90	96	101	104	107	110	101	95	86	79	110
Spokane, Wash.	28	55	59	74	87	95	96	103	104	98	86	70	57	104
Springfield, Ill.	30	73	72	91	89	92	98	107	100	99	91	77	67	107
Springfield, Mo.	22	75	76	92	89	90	98	106	102	102	90	79	74	106
Tampa, Fla.	19	82	86	92	90	94	95	96	96	94	93	87	83	96
Vicksburg, Miss.	37	82	83	88	92	95	101	100	100	98	94	86	79	101
Walla Walla, Wash.	24	67	69	74	92	100	105	111	113	100	87	78	65	113
Washington, D. C.	39	76	78	93	93	96	102	103	101	104	92	80	73	104
Williston, N. Dak.	31	52	58	72	92	101	107	106	107	101	95	71	59	107
Wilmington, N. C.	39	80	81	94	90	97	100	103	99	96	92	83	78	103
Winnemucca, Nev.	30	59	69	82	83	98	98	104	102	94	87	73	65	104

NORMAL TEMPERATURE: MONTHLY AND ANNUAL MEANS AT SPECIFIED STATIONS.[1]

[Source: The Weather Bureau, Department of Agriculture.]

Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
Abilene, Tex	43	45	55	64	72	78	82	81	74	64	53	45	63
Albany, N. Y	22	24	32	46	59	68	72	70	62	50	38	28	48
Amarillo, Tex	34	37	45	55	64	72	76	75	68	56	44	36	55
Atlanta, Ga	42	45	52	61	70	76	78	76	72	62	52	45	61
Bismarck, N. Dak	7	8	22	43	55	64	70	68	57	44	26	15	40
Boise, Idaho	29	34	42	50	58	66	73	72	62	50	40	32	51
Boston, Mass	27	28	35	45	57	66	71	69	63	52	41	32	49
Buffalo, N. Y	25	24	31	42	54	65	70	69	63	52	39	30	47
Charlotte, N. C	40	44	51	59	68	76	79	77	71	61	50	43	60
Chicago, Ill	24	25	34	46	56	66	72	71	65	53	39	29	48
Cleveland, Ohio	26	27	34	46	58	68	72	70	64	53	40	31	49
Denver, Colo	29	31	39	48	57	66	72	70	63	51	39	32	50
Des Moines, Iowa	20	24	36	51	62	70	76	73	65	52	37	26	49
Dodge, Kans	27	31	42	54	64	73	78	76	68	55	40	32	53
Dubuque, Iowa	18	22	33	49	61	70	75	72	64	52	36	24	48
Duluth, Minn	10	14	24	38	49	58	66	65	57	45	29	18	39
Eastport, Me	20	21	29	38	47	54	60	60	55	47	37	25	41
El Paso, Tex	44	49	56	64	72	80	80	79	73	62	51	45	63
Fresno, Cal	45	49	55	61	68	76	82	81	74	65	55	47	63
Galveston, Tex	53	56	62	69	75	81	83	83	79	72	63	56	69
Green Bay, Wis	15	17	27	41	54	65	70	67	59	47	32	21	43
Harrisburg, Pa	29	30	38	51	62	70	74	72	65	54	42	33	52
Havre, Mont	14	15	27	43	54	62	68	67	58	44	31	21	42
Helena, Mont	20	22	31	42	52	61	67	66	56	44	33	25	43
Huron, S Dak	10	13	27	45	57	67	72	69	60	45	27	16	42
Indianapolis, Ind	28	31	40	52	63	72	76	74	67	55	42	33	53
Jacksonville, Fla	54	57	62	68	74	79	81	80	77	70	61	55	68
Jupiter, Fla	64	66	69	72	76	80	81	82	81	77	72	66	74
Kansas City, Mo	26	30	41	54	64	73	78	76	68	56	42	32	53
Knoxville, Tenn	38	41	48	57	66	73	76	75	69	58	47	40	57
Lander, Wyo	17	22	31	42	52	61	68	66	55	42	29	19	42
Little Rock, Ark	41	44	53	63	70	77	81	79	73	63	52	44	62
Los Angeles, Cal	54	55	57	59	62	67	70	72	70	65	60	56	62
Louisville, Ky	34	37	45	56	67	75	79	76	70	58	46	38	57
Lynchburg, Va	36	38	45	56	66	74	77	75	68	57	46	38	56
Montgomery, Ala	48	51	58	65	74	79	81	80	76	66	56	49	65
New Orleans, La	53	56	62	68	74	80	81	81	78	70	61	54	68
New York, N. Y	30	31	38	48	59	68	74	72	66	56	44	34	52
Northfield, Vt	15	17	26	40	54	63	67	63	55	44	32	20	41
North Platte, Nebr	21	25	35	49	59	68	74	72	63	50	35	27	48
Oklahoma, Okla	35	38	49	60	68	76	80	78	72	61	48	39	59
Omaha, Nebr	20	24	36	50	62	72	76	74	66	54	38	27	50
Oswego, N. Y	24	24	31	43	55	64	70	69	63	51	39	29	47
Palestine, Tex	46	51	58	66	72	78	82	80	75	66	57	49	65
Parkersburg, W. Va	31	34	42	53	63	72	76	73	66	55	43	35	54
Phoenix, Ariz	50	54	60	67	75	84	90	89	81	70	59	52	69
Port Huron, Mich	22	22	30	42	54	64	69	67	61	50	37	27	45
Portland, Oreg	39	41	46	51	57	61	66	66	61	53	46	41	52
Rapid City, S. Dak	22	24	32	44	54	64	70	69	59	47	34	26	45
Red Bluff, Cal	45	49	54	59	66	76	82	81	74	64	53	46	62
St. Louis, Mo	31	34	44	56	66	75	79	77	70	58	43	36	56
St. Paul, Minn	12	15	28	46	58	67	72	70	60	48	31	19	44
Salt Lake City, Utah	29	33	41	50	58	68	76	76	65	52	40	32	52
San Antonio, Tex	51	54	62	69	75	80	82	82	77	69	59	53	68
San Francisco, Cal	50	51	53	54	56	57	57	58	59	58	56	51	55
Santa Fe, N. Mex	28	32	39	48	57	66	69	67	61	50	38	30	49
Sault Ste. Marie, Mich	13	13	21	36	48	58	62	61	54	43	31	20	38
Seattle, Wash	39	40	44	49	55	60	64	63	58	51	44	41	51
Shreveport, La	46	50	58	66	73	80	82	81	76	66	55	49	65
Spokane, Wash	27	30	39	48	56	63	69	68	59	47	37	31	48
Springfield, Ill	26	29	39	52	64	72	76	74	66	55	41	31	52
Springfield, Mo	31	34	44	56	65	72	76	75	68	57	44	36	55
Tampa, Fla	57	61	66	71	76	79	80	80	78	73	65	60	70
Vicksburg, Miss	47	51	58	65	73	78	80	80	75	65	56	49	65
Walla Walla, Wash	33	36	44	53	61	68	74	74	65	54	43	36	53
Washington, D. C	33	34	42	53	64	73	77	74	68	57	45	36	55
Williston, N. Dak	6	8	22	40	54	64	69	68	60	43	25	14	39
Wilmington, N. C	46	48	54	60	69	76	79	78	73	63	54	47	62
Winnemucca, Nev	29	33	40	47	54	63	72	71	60	49	38	31	49

[1] The figures cover the 33-year period, 1873 to 1905, inclusive. Those for stations not having that length of record have been corrected accordingly.

PRECIPITATION: NORMAL MONTHLY AND ANNUAL AT SPECIFIED STATIONS.[1]

[Source: The Weather Bureau, Department of Agriculture.]

Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Abilene, Tex	0.9	1.1	1.4	2.3	3.7	3.2	2.4	2.0	3.1	2.3	1.2	1.1	24.7
Albany, N. Y	2.6	2.5	2.7	2.4	3.0	3.8	3.9	4.0	3.2	3.0	2.8	2.6	36.4
Amarillo, Tex	.6	.9	.6	1.7	3.7	3.0	3.2	2.8	2.4	1.7	1.2	.8	22.6
Atlanta, Ga	5.3	4.6	5.8	3.6	3.1	3.9	4.7	4.5	3.5	2.3	3.4	4.5	49.4
Bismarck, N. Dak	.5	.5	1.0	1.9	2.5	3.5	2.1	2.0	1.2	1.0	.7	.6	17.6
Boise, Idaho	1.9	1.4	1.4	1.2	1.3	.9	.2	.2	.4	1.3	.9	1.7	12.7
Boston, Mass.	3.8	3.4	4.1	3.6	3.5	3.0	3.4	4.0	3.2	3.9	4.1	3.4	43.4
Buffalo, N. Y	3.3	2.8	2.6	2.4	3.1	3.1	3.4	3.0	3.2	3.5	3.4	3.4	37.3
Charlotte, N. C	4.3	4.4	4.6	3.4	3.9	4.5	5.5	5.6	3.2	3.2	2.9	3.9	49.2
Chicago, Ill	2.0	2.2	2.6	2.9	3.4	3.7	3.6	2.9	3.0	2.6	2.5	2.1	33.3
Cleveland, Ohio	2.4	2.6	2.8	2.3	3.2	3.7	3.6	3.2	3.2	2.7	2.8	2.6	35.0
Denver, Colo	.4	.5	1.0	2.2	2.5	1.5	1.6	1.3	.9	1.0	.5	.6	14.0
Des Moines, Iowa	1.2	1.1	1.6	3.0	4.6	5.0	3.9	3.6	3.1	2.7	1.5	1.3	32.4
Dodge, Kans	.5	.7	.9	1.9	3.3	3.3	3.4	2.6	1.8	1.4	.6	.6	20.8
Dubuque, Iowa	1.5	1.4	2.2	2.9	4.3	4.6	4.3	3.0	3.6	2.7	1.8	1.7	34.0
Duluth, Minn	1.0	1.0	1.6	2.1	3.5	4.5	3.6	3.5	3.6	2.7	1.6	1.2	29.9
Eastport, Me	3.8	3.6	4.3	2.9	3.8	3.2	3.4	3.3	3.0	3.8	4.1	4.0	43.3
El Paso, Tex	.5	.5	.4	.2	.4	.6	2.1	1.7	1.4	1.0	.6	.5	9.8
Fresno, Cal	1.6	1.3	1.8	.7	.6	.1	.0	.0	.3	.7	1.0	1.5	9.7
Galveston, Tex	3.6	3.1	2.9	3.1	3.2	4.8	4.0	5.0	5.4	4.2	4.0	3.7	47.1
Green Bay, Wis	1.7	1.6	2.4	2.4	3.6	3.6	3.5	3.1	3.1	2.4	2.0	1.8	31.1
Harrisburg, Pa	2.8	2.7	3.1	2.5	3.7	3.6	3.9	4.2	2.8	3.0	2.4	2.6	37.3
Havre, Mont	.7	.5	.5	1.0	2.1	2.8	1.9	1.3	1.0	.5	.8	.6	13.7
Helena, Mont	.9	.7	.7	1.1	2.0	2.1	1.1	.7	1.1	.8	.7	.8	12.8
Huron, S. Dak	.5	.4	1.0	2.6	2.9	3.8	2.9	2.6	1.7	1.3	.6	.6	21.1
Indianapolis, Ind	2.8	3.1	4.0	3.5	3.9	4.3	4.1	3.3	3.0	2.8	3.5	3.0	41.5
Jacksonville, Fla	3.1	3.4	3.5	2.7	4.2	5.5	6.2	6.2	8.0	5.1	2.2	3.0	53.2
Jupiter, Fla	3.6	3.0	3.1	2.6	4.8	6.9	5.4	5.8	9.6	9.5	3.0	2.9	60.2
Kansas City, Mo	1.1	1.6	2.8	3.3	5.1	4.7	4.8	4.8	3.8	2.2	1.8	1.4	37.4
Knoxville, Tenn	5.0	4.9	5.6	4.6	3.7	4.2	4.2	4.0	2.8	2.6	3.6	4.2	49.4
Lander, Wyo	.4	.6	1.6	2.5	2.9	1.1	.9	.5	1.0	1.0	.6	.7	13.9
Little Rock, Ark	4.8	4.2	4.9	4.5	5.1	4.1	4.0	3.6	3.3	2.6	4.6	4.2	49.9
Los Angeles, Cal	2.8	2.9	3.0	1.1	.5	.1	.0	.0	.1	.8	1.5	2.9	15.6
Louisville, Ky	3.9	3.8	4.3	4.1	3.6	4.2	3.7	3.5	2.6	2.6	4.2	3.7	44.3
Lynchburg, Va	3.7	3.5	3.8	3.2	4.0	3.9	4.0	4.2	3.6	3.4	2.8	3.3	43.4
Montgomery, Ala	5.1	5.5	6.4	4.2	3.8	4.2	4.7	4.2	2.9	2.4	3.1	4.5	51.2
New Orleans, La	4.6	4.5	5.3	4.9	3.9	6.2	6.5	5.6	4.8	2.9	3.8	4.5	57.4
New York, N. Y	3.8	3.7	4.1	3.3	3.2	3.3	4.5	4.5	3.6	3.7	3.4	3.4	44.6
Northfield, Vt	2.5	2.3	2.8	2.1	2.8	3.2	3.7	3.9	2.8	2.5	2.6	2.7	33.8
North Platte, Nebr	.5	.4	.9	2.2	3.1	3.2	2.7	2.5	1.5	1.2	.4	.5	18.9
Oklahoma, Okla	1.3	1.0	2.4	2.8	5.8	3.1	3.6	3.2	2.8	1.8	2.2	1.7	31.7
Omaha, Nebr	.6	.8	1.4	3.0	4.5	5.0	4.3	3.6	3.0	2.4	1.1	.9	30.7
Oswego, N. Y	3.2	2.6	2.8	2.3	2.8	3.4	3.2	2.7	2.8	3.3	3.4	3.6	36.2
Palestine, Tex	3.9	3.4	3.5	4.1	4.9	4.0	3.0	2.2	3.2	3.6	3.6	3.7	43.0
Parkersburg, W. Va	3.2	3.2	3.8	2.9	3.5	4.6	4.7	3.5	2.7	2.4	2.8	2.8	40.2
Phoenix, Ariz	1.2	.7	.5	.4	(2)	.1	1.1	1.0	1.0	.4	1.0	.6	7.9
Port Huron, Mich	1.9	2.2	2.4	2.1	3.2	3.2	2.7	2.6	2.7	2.7	2.7	2.2	30.6
Portland, Oreg	6.5	5.7	5.2	3.0	2.4	1.8	.5	.6	1.8	3.7	6.5	7.3	45.1
Rapid City, S. Dak	.4	.5	1.0	2.3	2.9	3.6	2.6	2.1	1.3	1.1	.5	.5	18.7
Red Bluff, Cal	3.9	3.6	3.8	1.8	1.3	.5	.0	(2)	.8	1.6	3.2	4.5	25.0
St. Louis, Mo	2.3	2.8	3.4	3.5	4.2	4.5	3.4	2.7	2.9	2.4	2.9	2.2	37.2
St. Paul, Minn	.9	.8	1.6	2.3	3.6	4.4	3.4	3.5	3.4	2.3	1.3	1.1	28.7
Salt Lake City, Utah	1.4	1.4	2.0	2.3	2.0	.8	.5	.8	.8	1.4	1.4	1.3	16.0
San Antonio, Tex	1.7	1.8	1.7	2.9	3.0	3.1	2.2	2.7	2.9	1.5	1.8	1.6	26.8
San Francisco, Cal	4.3	3.7	3.1	1.8	.8	.2	(2)	.0	.3	1.3	2.5	4.2	22.3
Santa Fe, N. Mex	.6	.8	.7	.9	1.1	1.0	2.7	2.4	1.6	1.1	.8	.8	14.5
Sault Ste. Marie, Mich	2.2	1.4	1.8	2.1	3.2	2.8	2.8	3.1	3.5	3.3	2.9	2.3	31.4
Seattle, Wash	4.5	3.9	3.6	2.7	2.3	1.7	.7	.5	1.9	2.9	5.9	6.0	36.6
Shreveport, La	4.4	3.6	4.5	4.6	4.2	3.6	3.7	2.2	3.2	3.2	4.1	4.4	45.7
Spokane, Wash	2.3	1.9	1.5	1.3	1.6	1.6	.7	.5	1.0	1.5	2.3	2.6	18.8
Springfield, Ill	2.2	2.8	3.1	3.3	4.5	4.3	2.9	2.8	3.4	2.6	2.7	2.4	37.0
Springfield, Mo	2.7	2.3	4.1	3.9	5.6	5.2	4.8	4.3	3.8	2.8	2.6	2.7	44.6
Tampa, Fla	2.8	3.3	2.8	1.8	2.9	8.3	8.4	8.6	7.4	3.0	1.7	2.0	53.1
Vicksburg, Miss	5.7	4.6	6.2	5.2	4.3	4.5	4.4	3.5	3.3	2.8	4.2	5.0	53.7
Walla Walla, Wash	2.0	1.6	1.9	1.7	1.8	1.2	.4	.4	.9	1.5	2.1	2.1	17.7
Washington, D. C	3.4	3.4	3.8	3.2	3.8	4.2	4.6	4.4	3.6	3.1	2.7	3.2	43.5
Williston, N. Dak	.6	.5	.7	1.2	2.3	3.6	2.0	1.3	.9	.8	.6	.7	15.1
Wilmington, N. C	3.5	3.4	3.6	2.9	4.0	5.6	7.0	6.5	5.3	3.7	2.4	3.1	51.0
Winnemucca, Nev	1.0	.9	1.0	.9	1.0	.6	.2	.2	.3	.5	.7	1.0	8.4

[1] The figures represent inches and cover the 36-year period, 1871 to 1906, inclusive. Stations not having that length of record have been corrected accordingly.

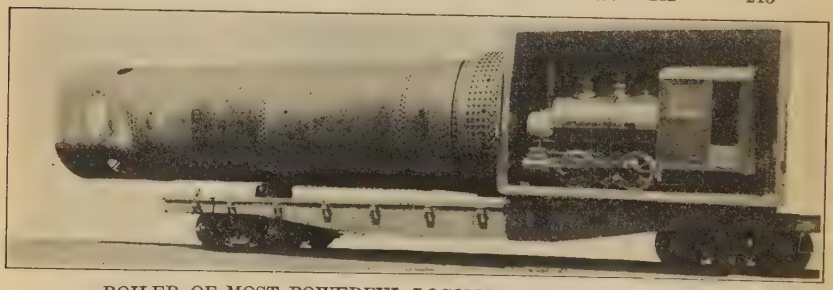
[2] Indicates trace of precipitation.

WHEN STARS ARE ADDED TO OUR FLAG.

We have met the opinion that a star was added immediately upon the proclamation of the President that a State was admitted to the Union. To make certain of the fact we referred the question to the Librarian of the War Department and have received from him a reference to the law upon the subject. It is found in U. S. Statutes at Large, 3:415, act of April 4, 1818, and enacts that the star for a new state shall be added to the flag upon the fourth of July succeeding the admission of the state. In accordance with this law two stars have been added to the flag on July 4, 1912, making 48 stars. They have been placed in six rows of eight stars each. The last states to be admitted to the Union were Arizona and New Mexico. Their Statehood bill was signed by the President on August 21, 1911, subject to certain changes in their constitutions. The proclamation of the President has been made admitting these states and their stars became part of the flag on July 4, 1912.

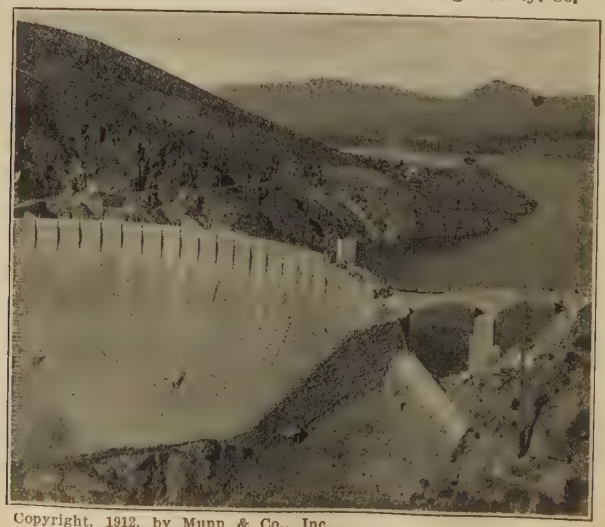
DIMENSIONS OF PRINCIPAL DOMES.

	Diameter.		Height.	
Pantheon, Rome, Italy.	142	ft.	143	ft.
Cathedral, Florence....	139	"	310	"
St. Peter's, Rome.....	139	"	330	"
Capitol, Washington, U. S. A.....	124¾	"	307½	"
St. Sophia, Constantinople.....	115	ft.	201	ft.
Baths of Caracalla, (Ancient Rome).....	112	"	116	"
St. Paul's, London.....	112	"	215	"



BOILER OF MOST POWERFUL LOCOMOTIVE IN THE WORLD.

This locomotive can haul 155 loaded 50-ton capacity freight cars at 10 miles per hour. It has 16 driving wheels. Locomotive and tender weigh 752,000 pounds. The firebox is large enough to hold a Dinkey switching locomotive. Built for the Virginian Ry. Co.



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THE ROOSEVELT DAM.

CHAPTER IV.

MACHINE ELEMENTS AND MECHANICAL MOVEMENTS

MACHINE ELEMENTS

The Machine Elements or Powers are the Lever and the Inclined Plane. Every machine when analyzed is found to be made up of these elements, either singly or in combination; for example, pulleys, gear wheels, etc., are forms of levers, while screws, cams, etc., are forms of inclined planes.

There are four distinct types of levers, as shown in our illustration.

1st. The Common Lever, consisting of a straight inflexible bar movable on a fulcrum. The section of the bar extending from the fulcrum to the point where the power is applied is called the Power Arm, and the section extending from the fulcrum to the point where the weight is applied is called the Weight Arm.

2d. The Angular or Bell Crank Lever. This is distinguished from the Common Lever in having its power arms disposed at an angle to the weight arms.

3d. The Wheel and Axle, or Revolving Lever. A wheel and axle or two concentric wheels take the place of the power and weight arms. The weight is attached to a rope coiled on one of the wheels, and the power is attached to a rope coiled on the other wheel. The relation of this lever to the common lever is indicated by the dotted lines, and it will be evident that this relation remains constant even when the wheels are revolving.

4th. The Pulley. Another type of revolving lever, but differing from the wheel and axle type in that a single wheel is used and the fulcrum is not necessarily always at the center of the wheel.

Each of these types of the simple lever is capable of three different arrangements usually termed "Orders." In the First Order the fulcrum lies between the weight and the power. In the Second Order the weight lies between the fulcrum and the power. In the Third Order the power lies between the fulcrum and the weight. The second order gives the longest power arm relative to the weight arm, and consequently is the most powerful lever of the three. The formulæ for determining the amount of power required to balance a given weight, are given at the bottom of the illustration. In measuring the arms of the angular levers the measurements should not be taken along the length of the arms, but in the horizontal plane as shown, because this measurement represents the true theoretical length of the lever arm. As the lever is moved about the fulcrum, the ratio of the power arm to the weight arm changes as indicated by dotted lines in the first order of angular levers, because the arm that is approaching the horizontal plane is increasing in length, while the other which is moving toward the vertical plane is decreasing in length. The same is true in a modified form of the second and third orders of angular levers.

In the case of the pulleys the power and weight arms bear a definite relation to each other. No matter what their size may be, the power arm will always be of the same length as the weight arm in pulleys of the first order, consequently the power must be equal to the weight in order to keep the lever in equilibrium. In pulleys of the second order the power arm will be twice the length of the weight arm, consequently the power must be equal to half of the weight in order to keep the lever in equilibrium; and in pulleys of the third order the power arm will be half the length of the weight arm, consequently the power must equal twice the weight in order to maintain the equilibrium of the lever.

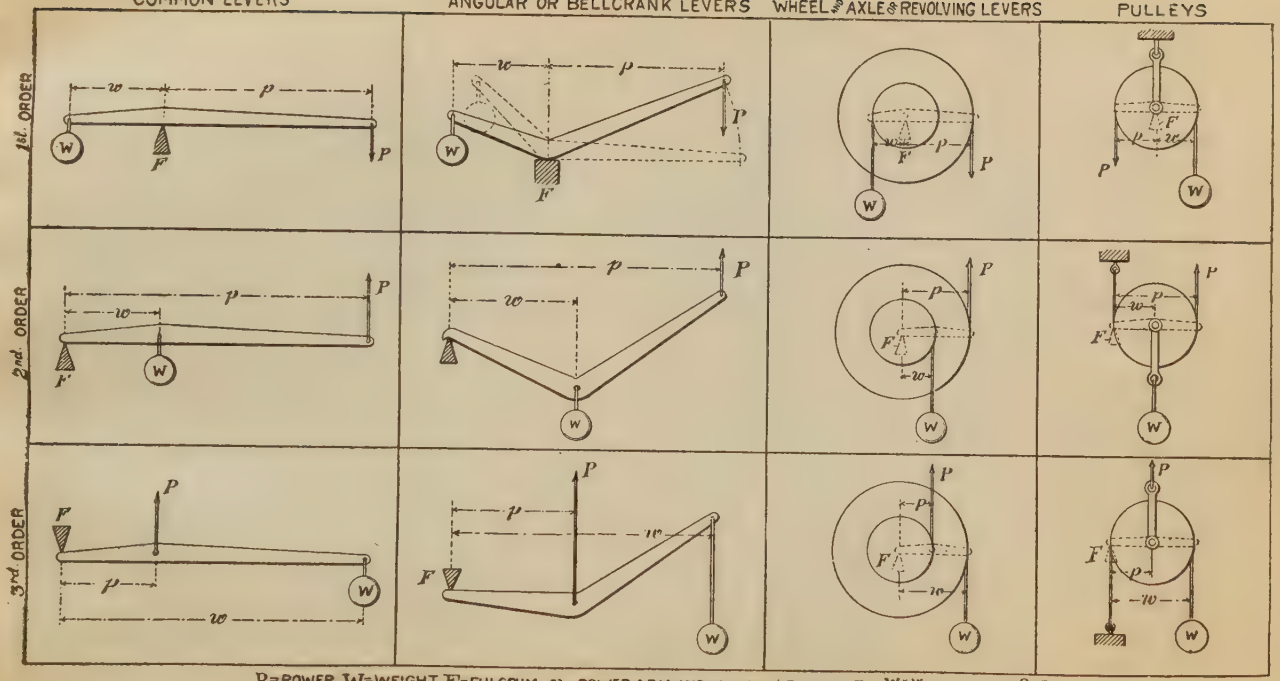
The compound levers consist of two or more simple levers of the same or different orders coupled together, either for the purposes of convenience or to increase the power.

Of the two compound common levers illustrated, Figure 1 shows two common levers of the first order coupled together, and Figure 2 represents a common lever of the first order coupled to a common lever of the second order.

The compound revolving lever illustrated is a combination of a wheel and axle of the second order, operating a pulley of the second order. This compound lever is also called a "Chinese windlass," owing to its early use by the Chinese for lifting heavy weights, such as draw-bridges, etc.

The compound pulleys or tackle shown are various combinations of pulleys of the same or different orders. As in the case of the simple pulleys, the weight and power arms bear a constant relation to each other, and it is therefore possible to give the numerical value of the power in terms of the weight, or *vice versa*, afforded by the different types of tackle, regardless of the size of the individual pulleys they comprise. The following simple formula is applicable to all tackle in which a continuous length of rope is used, as in Figures 1, 2, and 3: *Power equals weight divided by the number of rope parts supporting the weight.* In Figure 3, for instance, there are five such parts, not counting of course the part on which the power is applied. Figures 4 to 9 are all rather complex, owing to the fact that the power is transmitted to the weight through one or more movable pulley blocks connected by separate ropes. Figures 4 and 5 show tackle arrangements called Spanish burtons. A general formula, applicable to any number of pulleys arranged as in Fig. 6, is $P = \frac{W}{2^n - 1}$,

LEVERS


COMMON LEVERS
ANGULAR OR BELLCRANK LEVERS
WHEEL & AXLE & REVOLVING LEVERS
PULLEYS
1st. ORDER
2nd. ORDER
3rd. ORDER
P=POWER W=WEIGHT F=FULCRUM p=POWER ARM AND w=WEIGHT ARM
P = W x w / p AND W = P x p / w

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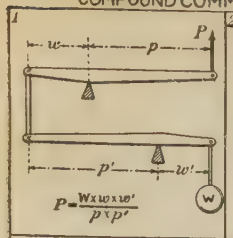
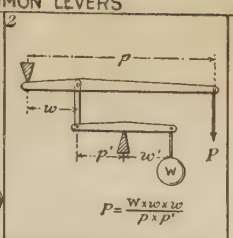
MACHINE ELEMENTS I.

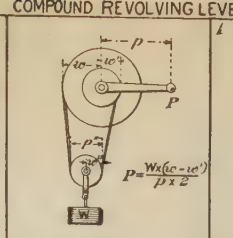
COMPOUND LEVERAGE

COMPOUND COMMON LEVERS

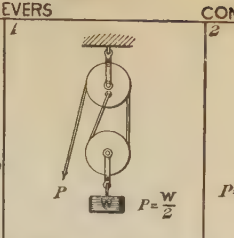


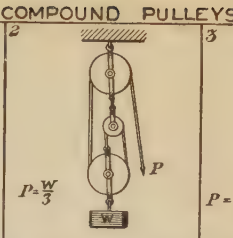


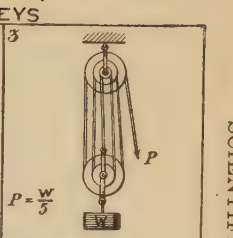
COMPOUND REVOLVING LEVERS

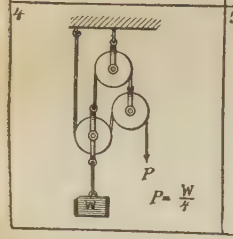


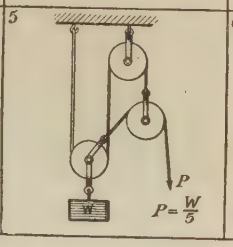
COMPOUND PULLEYS

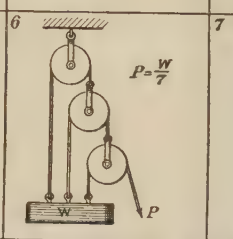


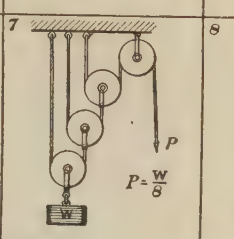


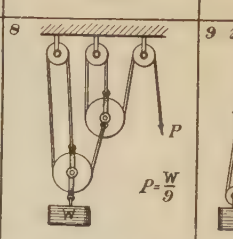


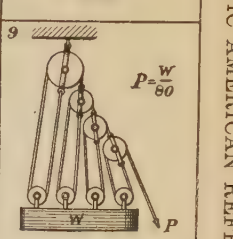






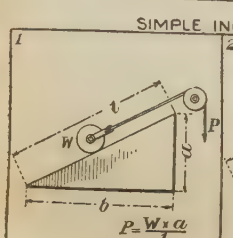


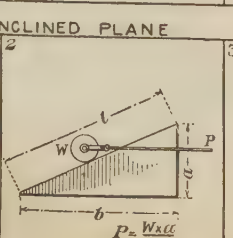


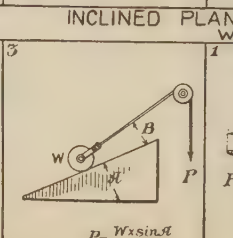


INCLINED PLANE

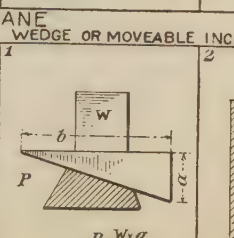
SIMPLE INCLINED PLANE

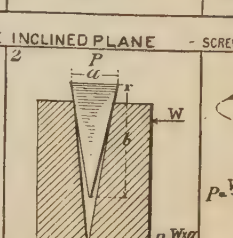




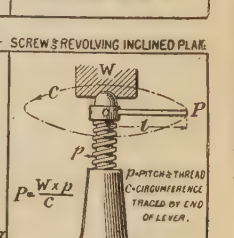


WEDGE OR MOVEABLE INCLINED PLANE





SCREW & REVOLVING INCLINED PLANE



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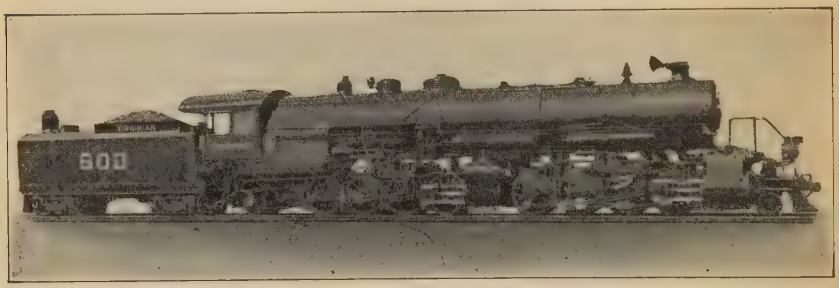
in which P represents the power, W the weight, and n the number of ropes used. The general formula for the arrangement shown in Figure 7 is $P=\frac{W}{2^n}$. The general formula for the arrangement shown in Figure 8 is $P=\frac{W}{3^n}$. The general formula for the arrangement shown in Figure 9 is $P=\frac{W}{3^n\ 1}$.

There are three general classes of inclined planes, the simple inclined plane, the wedge or movable inclined plane, and the screw or revolving inclined plane. There are three general types of simple inclined planes, as illustrated. 1st. That in which the power acts in a direction parallel with the inclined face of the inclined plane. 2d. That in which the power acts parallel with the base of the inclined plane. 3d. That in which the power acts at an angle both to the face and to the base of the inclined plane. The formulæ for determining the mechanical advantage secured by the different forms of inclined planes are given in the illustration. In the third type of inclined plane the relation of power to weight changes as the weight is drawn up the plane, owing to the fact that the angle B becomes gradually larger.

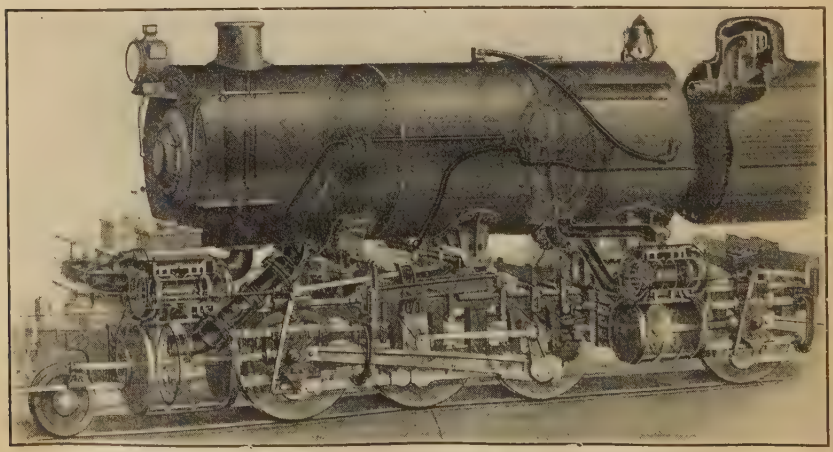
There are two types of wedges, the single wedge and the double wedge. The latter is the more common type.

Under revolving inclined planes we have the screw together with the cam (not illustrated here), which are more commonly used in machinery than any other type of inclined plane.



MALLET ARTICULATED LOCOMOTIVE FOR THE VIRGINIAN RY. CO.

This is a fine type of locomotive. It develops a tractive force of 97,200 pounds, and is capable of hauling a train of twenty cars, weighing 78 tons each, with a caboose, up a compensated grade of two and seven hundredths per cent. The boiler is of the separable type with a feed-water heater in the front section. This locomotive is capable of traversing 23° curves.



PIPING ARRANGEMENT OF BALDWIN MALLET LOCOMOTIVE.

Note flue leading through feed-water heater.

MECHANICAL MOVEMENTS

TOOTHED GEAR.

1. SPUR GEARS.—The ordinary form of toothed-wheel. The smaller of two intermeshing gear-wheels whether a spur- or bevel-wheel is called a Pinion.

2. GEAR WITH MORTISED TEETH.—This is what is ordinarily known as a Cog-wheel among machinists. The wheel is ordinarily made of iron and the teeth of wood.

3. STEP GEAR.—The face of this gear is divided into sections with the teeth of the different sections arranged in steps; that is, one in advance of the other. Step gear-wheels are useful in heavy machinery, as they give a practically continuous bearing between the intermeshing teeth of the gear-wheels.

4. OBLIQUE TOOTHED GEAR.—The teeth are cut diagonally across the working face of the wheel so as to give the gear-wheel a side thrust. In a double oblique toothed-gear, usually called a V-toothed gear, the thrust in one direction is neutralized by an equal thrust in the opposite direction. As in the stepped-gear it gives a continuous bearing of the teeth.

5. INTERNAL OR ANNULAR GEAR.—The teeth are formed on the inner periphery of a ring. This type of gear is used in heavy machinery, because it offers a greater hold for the teeth of the driving pinion. There is less sliding friction between the teeth than in the usual outside spur-gear and pinion.

6. STAR WHEEL GEARS.—The teeth are so formed as to permit an appreciable separation of the gear-wheels without preventing them from properly meshing one with the other. These gears are used on wringing machines, etc.

7. ELLIPTICAL GEARS.—Due to their elliptical form, while the driving-gear rotates at constant speed, the other gear will be rotated at a variable speed. That is, its motion will first be accelerated and then retarded. They are used in some machines to produce a slow powerful stroke followed by a quick return.

8. ANGULAR GEARS.—These gears have a rectangular form and, as in the elliptical gears, they serve to transform uniform rotary movement into variable rotary movement. However, this movement is more jerky than that produced by elliptical gears. Angular gears are very seldom used.

9. LANTERN GEAR.—The teeth consist of pins which lie parallel with the axis of the gear-wheel, and are secured at their ends in two disks or gear heads. The pins are so spaced as to mesh with the teeth of a spur-gear. The lantern-gear permits limited sliding movement of the spur-gear along its axis. It can be very cheaply made, but is used chiefly for light work, such as clock mechanism, etc.

10. CROWN GEAR.—The teeth project perpendicularly from a side face of the wheel instead of lying in the plane of the wheel. When in mesh with the teeth of a spur-gear or a lantern-gear, it forms a cheap method of transmitting power from one shaft to another lying at right angles thereto. Crown gears are useful for light work, and were common in old clock mechanisms. They used to be known as *Contrate* wheels.

11. BEVEL GEARS.—The ordinary gear for transmitting power from one shaft to another at an angle thereto. When the wheels are of the same size and operate on shafts, lying at an angle of 45 degrees, one with the other, they are called Miter gears.

12. WORM OR SCREW GEAR.—An endless screw engages a spur-gear with spirally disposed teeth. The screw is called a worm, and the spur-gear a worm-wheel. A much diminished but very powerful motion is communicated from the worm to the worm-wheel. It is used in heavy machinery.

13. CURVED WORM GEAR.—The working face of the worm is curved so that a number of teeth will be in mesh with the worm-wheel, thus giving greater strength. It is a difficult matter to cut the thread of this worm correctly owing to its varying pitch. The gear is called the saw-tooth gear when the teeth and thread are V-shaped, as illustrated.

14. SPIRAL OR HELICAL GEARS.—The teeth are spirally disposed on the working faces of the wheels so that they will transmit motion to shafts lying at right angles one with the other.

15. SKEW GEARS.—The gears rotate on shafts which lie in different planes and at an angle with each other. The drawing shows a skew spur-gear meshing with a bevel-gear. The same term would apply to two bevel gears lying in different planes and at angles to each other.

16. RACK AND PINION.—A spur-gear engages a toothed bar. Rectilinear motion is by this mechanism transformed to rotary motion or vice versa. It is quite common in heavy machinery to find a worm meshing with and driving a rack.

17. SPHERICAL OR GLOBOID GEAR.—A spiral thread is cut on a spherical body and meshes with the spiral teeth of the spur pinion. The latter is so mounted that it may be swung to different positions on the spherical gear, without varying its speed of rotation.

18. GEAR WITH ROLLER TEETH.—The teeth project from the flat face of the wheel, and consist of pins carrying rollers. This construction is used to reduce friction.

19. PIN WHEEL.—The flat face of the gear is studded with pins which are adapted to

mesh with slots formed in the edge of a pinion. The pinion is so mounted that it can be moved toward or from the center of the pin wheel to vary its speed of rotation. When the pinion is moved past the center of the pin wheel its direction of rotation is reversed.

20. Spiral Hoop Gear.—A spiral thread is formed on the flat face of the wheel and this meshes with a worm-wheel. The latter is moved forward one tooth at each complete rotation of the spiral hoop. This gives a powerful drive, though, of course, at a greatly diminished speed.

21. Intermittent Gear or Geneva Stop.—The driving-wheel is provided with a single tooth adapted to engage one of a series of notches in the other wheel. At each complete rotation of the driving-wheel the other wheel is moved forward one notch but no more, due to the concave space between the notches which fits closely against the circumference of the other wheel. In the Geneva stop one of these spaces is formed with a convex outline, as illustrated. When this space is reached both wheels are prevented from further rotation forward. The Geneva stop is used on watches to prevent winding up the main spring too tightly.

22. Intermittent Bevel Gear or Mutilated Gear.—The teeth are formed only at intervals on the face of the gears. The space between the teeth in the driving-gear is convex, and that between the teeth in the other gear is concave, so that when the teeth are not in mesh with each other these convex and concave portions fit into each other and prevent the driven gear from moving forward under its own momentum.

23. Variable Gears.—The gear wheels are made up of gear sectors of different radial length, which produce suddenly varying motions of the driven gear due to the varying leverage between the wheels. The segments are arranged on different planes so as not to interfere one with the other.

24. Scroll Gears.—The gears have a scroll form which produces a gradually increasing or decreasing speed during each rotation. These gears are also called cam gears.

25. Elliptical Bevel Gears.—They produce variable motion of a shaft lying at right angles to the driving shaft. This gear is used on bicycles to give increased power on the downstroke of the pedal and a quick movement on the return.

26. Variable Pin Wheel.—A cone is provided with pins arranged spirally thereon, and these mesh with teeth formed on the other cone. When one cone is rotated at a constant speed the other moves with a gradually increasing or decreasing speed during each rotation.

27. Cam-toothed Pinion.—The pinion consists of two oppositely disposed heart-shaped teeth, mounted side by side, on a shaft. The gear-wheel with which they mesh has teeth alternately arranged on opposite side faces. Due to the form of the pinion teeth, the gear-wheel is locked after being moved forward by one tooth until the other tooth comes into mesh with a tooth on the other face of the wheel.

28. Bevel Scroll Gear.—The gear-wheel consists of a bevel spiral scroll which meshes with a bevel pinion. As the spiral scroll rotates it causes the pinion to slide forward on its shaft, and thus varies its speed.

FRICTION GEAR.

29. Flat-faced Friction Gear.—A common type of friction gear. The wheels are usually faced with rubber or leather to increase the frictional hold between the wheels. One of the wheels is journaled in bearings which can be adjusted toward the other wheel so as to increase the frictional engagement.

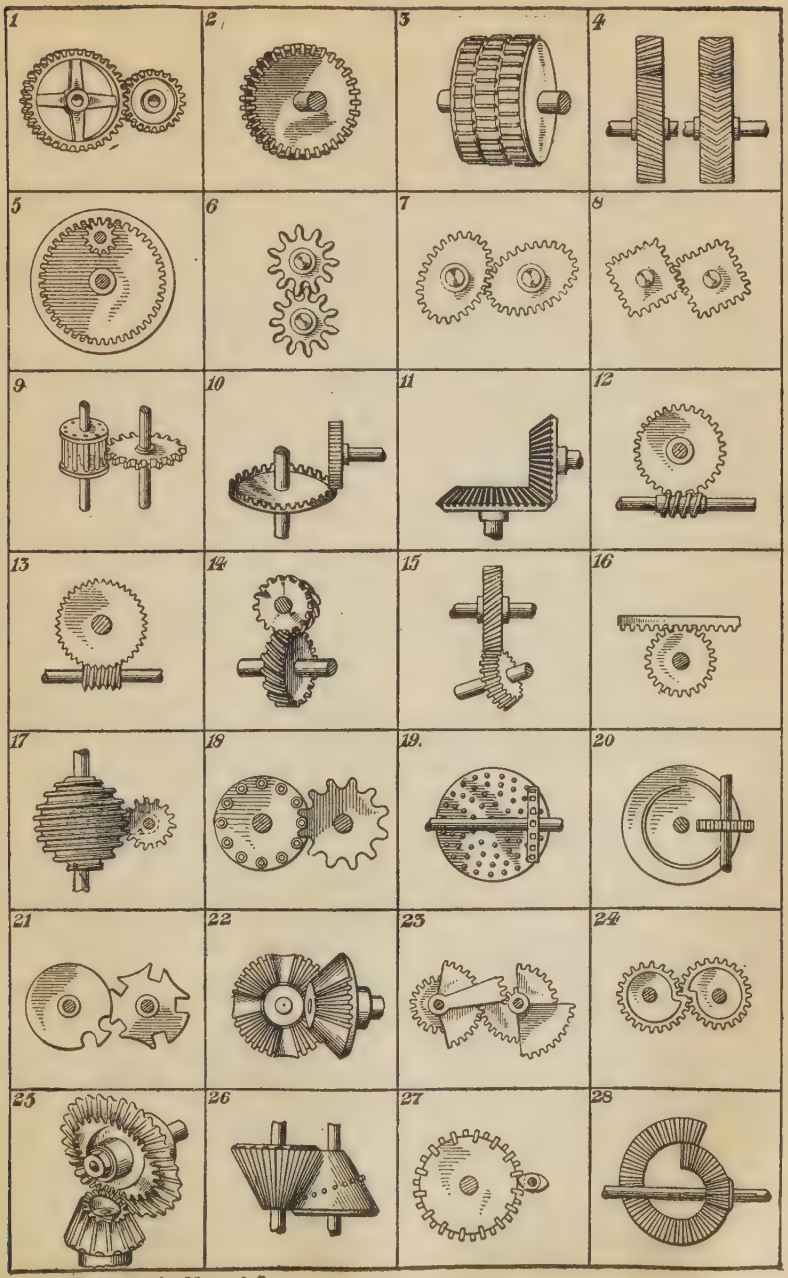
30. Grooved Friction Gear.—The faces of the wheels are grooved so as to increase the bearing surface. The best results are obtained by pressing the wheels but slightly into engagement with each other, as this produces little loss of power by friction.

31. Adjustable Friction Pinion.—The pinion is formed of a disk of rubber or other flexible material held between two washers. When these washers are tightened together they press out the rubber between them, crowding it into closer contact with the V-groove of the gear with which it engages.

32. Beveled Friction Gear.—Two cone frustums are used to convey motion from one shaft to another at right angles thereto.

33. Friction Drums.—The drums have concave faces which permit them to transmit motion one to the other while lying at an acute angle with each other.

34 to 40. Variable Speed Friction Gear.—34, a pinion, engages the flat face of the friction disk. Variable motion is produced by moving the pinion across the face of the disk. When the center of the disk is reached no motion is transmitted. Beyond the center the direction of motion transmitted is reversed. 35. Motion is transmitted from one friction disk to another lying parallel, but not in alignment therewith, through an intermediary pinion. This pinion can be moved vertically to engage different points on the friction disks, and thus produce any desired variation in the speed transmitted. 36. Two convex friction disks are so arranged that one may be swung through an angle bringing different points on its surface into contact with the face of the other disk. In this manner the speed of the motion transmitted is varied. This gear is used on sewing-machines. 37. Two parallel friction disks are each provided with an annular concavity. Motion is transmitted from one disk to the other by a friction pinion mounted between the disks, and so arranged that it can be rotated to engage different points on the surfaces of the concavities, thereby varying the speed transmitted. 38. A cone with concave face is engaged by a pinion which may be swung about a center to engage different points on the face of the cone. 39. Two cones with concave faces are mounted on shafts running at right angles to each other. Motion is transmitted from one cone to the other through a friction pinion mounted to swivel so as to engage different points on the faces of the cones. 40. Two friction cones are mounted on parallel shafts, and between them runs a friction pinion having two faces, one engaging the upper cone and the other engaging the lower cone. This provides a broad bearing surface. The pinion may be moved to different positions along the faces of the cones, and thereby produce changes in the speed.



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CHAIN GEAR.

41. Sprocket Wheel.—The wheel is provided with teeth adapted to fit in between the links of a chain. The chain may be of the ordinary oval welded link type or of the flat riveted type used on bicycles.

42. Link-belt Wheel.—The chain is made up of square links which are engaged by ratchet-shaped teeth on the chain wheel.

43. Pocket Wheel.—The wheel is formed with pockets into which the links of the chain are adapted to fit.

44. Side-toothed Wheel.—The wheel is formed with two sets of teeth between which the chain travels. The teeth bear against the ends of the outer links of the chain.

45. Side and Center Toothed Chain Wheel.—This wheel is similar to that shown in Fig. 44, but has in addition a row of teeth along the center which bear against the center link of the chain.

46. Toothed-link Chain and Wheel.—The links are formed with projecting teeth which fit into notches on the rim of the chain wheel.

47. "Silent" Chain and Wheel.—This is a special type of chain in which each link is formed with a tooth at each end. The teeth of adjacent links coact to completely fill the spaces between the teeth of the chain wheel. The construction is such as to produce a noiseless operation of the chain gear even at high speeds.

48. Detachable Toothed-link Belt and Wheel.—Each link is formed with a tooth, which meshes with the teeth of the chain wheel. The construction of each link is such that it may be readily slipped into or out of engagement with the next link of the chain.

ROPE GEAR.

49. V-Pulley.—The ordinary type of pulley for round ropes or cables. Owing to the V-shaped construction of the pulley groove, the rope wedges tightly into engagement with the pulley.

50. Pulley with Flexible Filling.—In order to secure frictional engagement of the cable with this pulley, the pulley groove is provided with rubber, leather, wooden, or other filling.

51. Pulley with Ribbed Groove.—In this construction of pulley the required grip is produced by forming ribs in the bottom of a pulley groove.

52. Pulley with Gripping Lugs.—The flanges of this pulley are formed with lugs which kink the rope or cable as shown, thus producing the required grip.

53. Rope Sprocket-wheel.—An old form of rope gear used in hoists and the like.

54 and 55. Gripping Pulleys.—Gripping arms are provided which grip the cable at the point where the cable presses into the pulley. In 54 the gripping arms are wedged inward by the side walls of the pulley groove when pressed downward by the cable. These arms are normally h ld up by coil springs. In 55 the cable is gripped by the toggle movement of hinged clips placed at intervals along the periphery of the pulley.

56. Cable Sprocket-wheel.—The cable is provided with clamps which enter sockets formed in the cable wheel. This is a form of cable gear commonly used at present in elevating and conveying machinery.

CLUTCHES.

57. Common Jaw Clutch.—One member of the clutch is mounted to slide on a feathered shaft, and the other member which is connected with the machinery is normally stationary on this shaft. When the slidable member is moved forward the teeth on its forward edge intermesh with the teeth of the other member, setting the machinery in motion. The slidable member is moved forward by means of a forked lever which is hinged to a split collar mounted loosely between flanges on the clutch member.

58. Claw Clutch.—The slidable member of the clutch consists of a body portion with two claw arms which, when moved forward, are adapted to engage opposite sides of a bar on the other member of the clutch.

59. Lever Clutch.—The slidable member is provided with a lever loosely hinged to its forward end. The other member of the clutch consists of a disk formed with ratchet teeth on its face. These are engaged by the hinged arm when the shaft rotates in one direction, but the arm moves freely over them when rotated in the opposite direction.

60. Knee and Rose Clutch.—A crank arm is attached to the slidable member of the clutch, and engages a pin on an arm loosely hinged to the opposite member of the clutch.

61. Ratchet Clutch.—The clutch members are formed with ratchet teeth, so that when the motion of the driving shaft is reversed, the members will be disengaged.

62. Pin Clutch.—The slidable member is provided with radial arms formed with pins at their outer ends which are adapted to enter sockets formed along the periphery of a disk on the opposite member of the clutch.

63. Friction Disk Clutch.—The two clutch members are each formed with disks preferably faced with rubber or leather, so that when pressed together their frictional engagement will cause a transmission of motion from the rotating disk to the other.

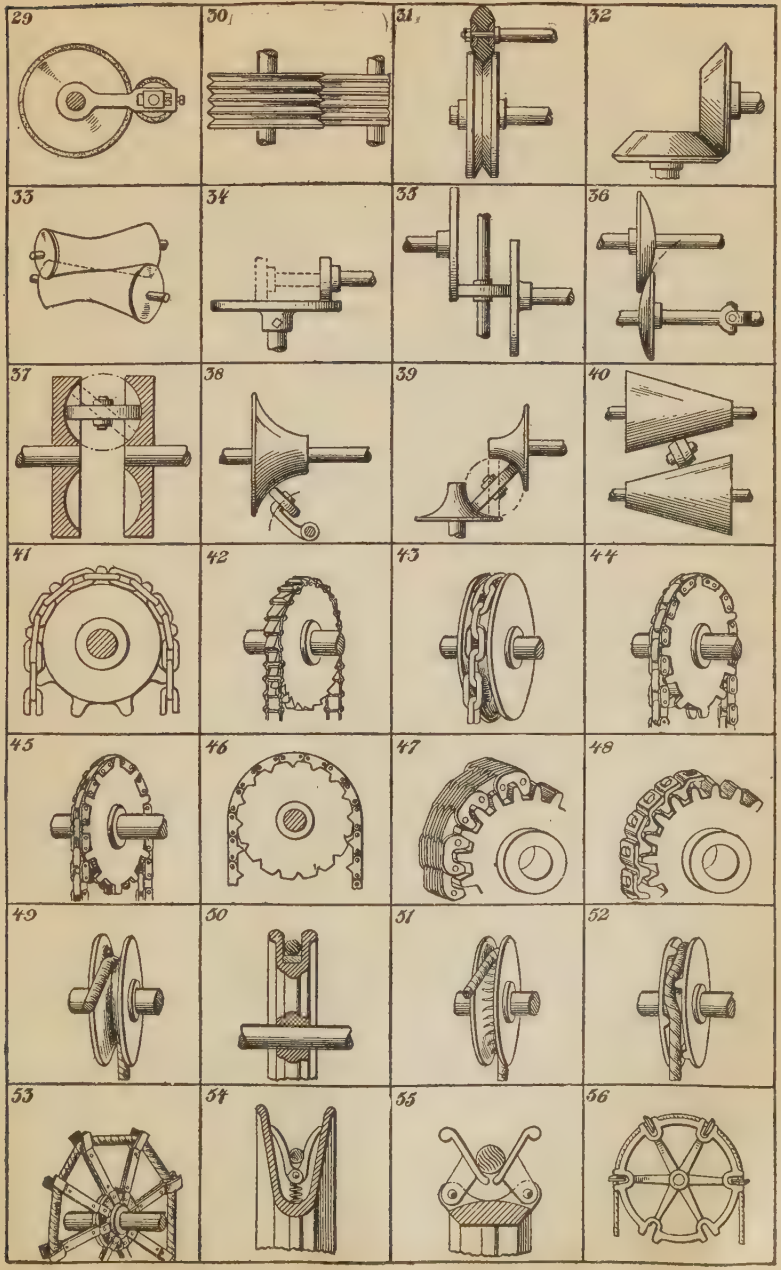
64. Friction Groove Clutch.—One of the clutch members is formed with a groove in its face to receive the lip of the other member which is cup-shaped. Both the lip and the side walls of the groove are slightly tapered to insure a close fit, even after the parts have been partly worn away by friction.

65. Stud Clutch.—Engagement between the two members of the clutch is effected by means of a stud on each disk adapted to enter a notch formed in the periphery of the opposing disk.

66. Friction Band Clutch.—One member of the clutch consists of a pulley provided with a steel band which encircles and fits tightly on its periphery. The other member of the clutch consists of a lever provided with pins at its outer ends, which are adapted to engage the steel band. Since this band is not fastened to the pulley, any shock due to suddenly throwing the clutch members into engagement will be taken up by the steel band slipping on the face of the pulley.

67. Friction Cone Clutch.—The clutch is made up of two cones, one adapted to fit into the other. The frictional engagement causes one to drive the other.

68. Self-releasing Clutch.—The clutch disks are provided with inclined teeth, so that in case the resistance to the driven shaft in-



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creases beyond a certain degree, the clutch members will automatically move apart.

69. Cam Clutch.—One of the members is cup shaped, and within this the other member operates. The latter comprises a number of cam-shaped arms hinged to a body portion, and so arranged that when moved in one direction they will bind against the inner wall of the drum, but when moved in the opposite direction they will be automatically disengaged therefrom.

70. V-grooved Clutch.—The clutch disks are formed with annular V-grooves adapted to fit into each other, and thus increase the friction surface of the clutch members.

71. Expansion Clutch. — The slidable member is provided with a number of movable ring segments connected by radial arms to the main body of the clutch and adapted to bear against the inner surface of the drum or cup which constitutes the other member of the clutch. When the slidable member is moved forward, by reason of the toggle action of the radial arms, the segments are brought into frictional engagement with the other member of the clutch.

72. Coil-grip Clutch. — The movable member of the clutch is formed with a number of coils of steel in which there is a central conical opening. This is moved over the cone which constitutes the opposite member of the clutch, producing the required frictional engagement of the two members.

ANGLE SHAFT COUPLINGS AND UNIVERSAL JOINTS.

73. Crank and Hinged-pin Coupling.—A coupling for shafts which lie at an angle to each other. One shaft carries a hinged pin which fits into an opening in the outer end of a crank arm carried by the other shaft.

74. Double-sleeve Angle Coupling.—Each shaft carries a crank arm provided with a pin at its outer end, which lies parallel with its respective shaft. The two pins enter a coupling device consisting of two sleeves integrally formed, but lying at an angle with each other which corresponds to the angle formed by the shafts. Through this double-sleeve coupling, motion is transmitted from one shaft to the other, the pins sliding back and forth in the sleeve openings.

75. Cross-bar Angle Coupling.—This is used for coupling two parallel but offset shafts. Each shaft carries a yoke piece provided with sleeves at its outer ends. The coupling member is a cross-shaped piece, its arms fitting into the sleeves of the yoke pieces, and permitting the necessary lateral play as the shaft rotates. This form of coupling is also applicable to shafts which lie at an angle with each other.

76. Pin and Slot Coupling.—A crank pin carried by one shaft engages a slot in a crank arm carried by the other shaft. The motion transmitted is variable, due to the fact that the leverage varies as the pin moves up and down in the slot.

77. Ring-Gimbal Universal Joint.—The ends of the shafts are provided with yoke members whose arms are pivoted to a ring-gimbal, the pivot pins of the two yoke pieces lying at right angles to each other. This coupling will communicate motion at any angle under 45 degs. For angles of over 45 degs. a double-link universal joint is used.

78. Double-link Universal Joint.—A link forked at each end is hinged to two rings, which are mounted in the yoke pieces on the ends of the shafts. In place of rings cross pieces such as shown in the illustration are often used.

79. Hooke's Angular Coupling.—The shafts are connected by two double links which are arranged in the form of a parallelogram. Intermediate of the shafts the links are connected with ball-and-socket joints.

80. Ball-and-socket Universal Joint.—Socket pieces are secured to the ends of the shafts, and these are provided with metal bands which encircle the ball that constitutes the coupling member. The bands enter grooves in the ball which lie at right angles to each other.

81. "Almond" Angular Coupling.—A side view of the coupling is shown at 1 and a plan view at 2. Between the shafts to be coupled is a fixed stud on which a bell crank is mounted to turn. The bell crank is permitted to slide axially on the stud. The bell crank is connected at the ends by ball-and-socket joints with links attached to the ends of the shafts. Now, as the power shaft rotates, rotary motion will be communicated to the other shaft through the bell crank, which will rock and also slide axially on the stud.

82. Flexible Shaft.—Two shafts are connected by a flexible shaft consisting of a coil spring, or a metal tube in which a helical saw-slot has been cut. This flexible shaft will permit transmission of motion through a wide angular range.

83. Linked Flexible Shaft.—The flexible shaft is made up of a series of links coupled together with universal joints. A coil spring fits loosely over the links and prevents them from kinking. This spring in turn is covered with a flexible tube. The shaft will transmit motion about almost any curve or angle. It can be used for heavy work.

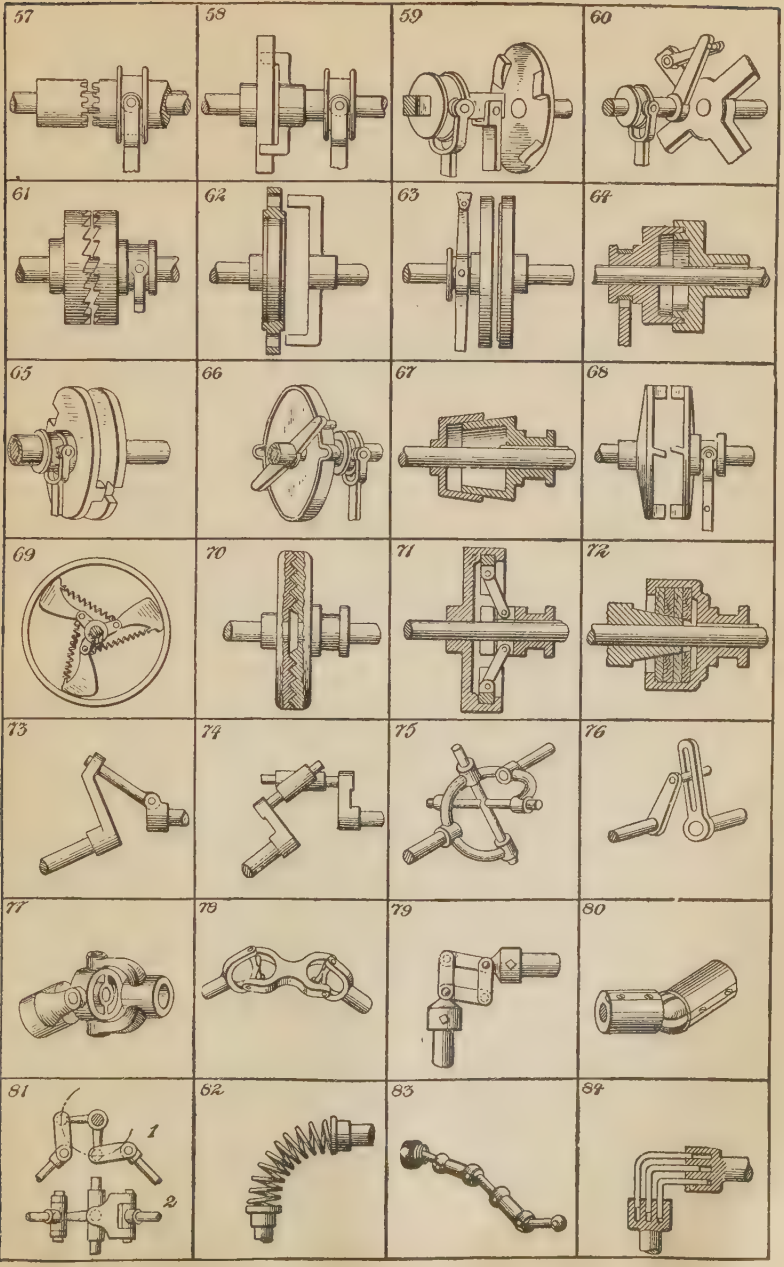
84. Right-angle Coupling.—The ends of the shafts are formed with heads in which are drilled a number of sockets. A series of rods, each bent to form a right angle, enter these slots and form the coupling links between the shafts. As the shafts rotate these rods slide in and out of their sockets.

RATCHET MOVEMENTS.

85. The teeth of a ratchet wheel are engaged by a pawl hinged to a rocking arm. The ratchet wheel is rotated only on the forward stroke of the arm.

86. A rocking lever carries two pawls; one on each side of its fulcrum. The wheel is rotated both by the downward and the return stroke of the lever; for while one pawl is rotating the wheel, the other swings to position to take a new hold on the ratchet wheel. The rotation of the ratchet wheel is thus kept nearly constant.

87. A ratchet crown-wheel or rag-wheel is engaged by pawls depending from two arms loosely pivoted on the axle of the ratchet-wheel. These two arms are connected by links to a common power arm. Rectilinear reciprocating movement of the latter in the line of the arrow produces an almost constant rotation of the ratchet-wheel.



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88. The action of this ratchet mechanism is very similar to that shown in Fig. 86, except that the pawls are hooked and ratchet-wheel is rotated by an alternating pulling rather than pushing action of the pawls.

89. This is a modification of the principle pictured in Fig. 88, and shows a rocking lever with two pawls hinged thereon engaging a ratchet rack.

90. Another modification of the principle shown in 88. The rocking lever is mounted on a fixed stud and is provided at the center with a pin which enters a slot in a ratchet bar. The latter is formed with ratchet teeth on its opposite edges which are engaged by hooked pawls pivoted on the rocking lever. These pawls are crossed, as shown, so that they will be kept by gravity in constant engagement with the ratchet teeth. Now, when the lever is rocked the pawls will alternately act to lift the ratchet bar.

91. A common construction used for rotating a ratchet-wheel against a spring resistance. A dog mounted on a fixed pivot drops by gravity or by spring pressure against the ratchet teeth and holds the wheel from turning while the pawl is being swung back for a fresh hold on the ratchet-wheel.

92. This shows the method of rotating an ordinary spur gear-wheel by means of a pawl. The pawl is provided with a tooth at its outer end which fits between the teeth of the gear. The pawl is hinged to the lower arm of the bell-crank lever mounted on the gear shaft. The operating lever also mounted on this shaft is permitted a certain amount of play between two pins on the shorter arm of the bell crank-lever. A rod connects the operating lever with the pawl. When the lever is raised it first lifts the pawl out of engagement with the gear, then, coming in contact with the upper pin on the bell crank-lever, it moves the pawl and bell crank back to the desired position. On lowering the operating lever the pawl is first brought into engagement with the gear and then the lower pin on the bell crank is encountered, and the gear is caused to rotate. This arrangement prevents wearing away of the teeth—a common defect in the ordinary type of ratchet mechanism.

93. The pawl is kept in contact with the ratchet-wheel by the weight of the lever on which it is formed. By pulling the rope attached to the end of the lever the pawl will be drawn out of engagement with the ratchet-wheel, and the latter will be turned by friction of the rope on the wheel hub.

94. A reversible spur-gear ratchet mechanism. Mounted on the shaft which carries the spur-gear is a bell crank-lever. This at one end carries a double-toothed pawl, one of which teeth meshes with the teeth of the gear. The pawl is so shaped that it will withdraw the tooth from engagement with the gear teeth on the return stroke of the lever. When it is desired to reverse the direction of rotation, the pawl is moved over to the position shown in dotted lines, bringing its other tooth into engagement with the gear teeth.

95. The ratchet-wheel is intermittently rotated by the oscillation of a lever which carries a spring-pressed pawl. On the upward stroke the ratchet is turned by the pawl which is backed by a shoulder on the lever. On the return stroke a dog holds the ratchet-wheel from turning while the pawl snaps past.

96. Ratchet teeth are formed on a ball which rests in a socket formed at the end of a lever. A spring pawl on this lever engages the ratchet teeth at any position of the lever. This construction is useful for ratchet braces which have to be operated in inconvenient places.

97. A device for converting rotary motion into vibratory motion. A spring-pressed pin engages the teeth of a revolving crown-wheel ratchet, and is thereby caused to vibrate.

98. A device for converting reciprocating motion into intermittent rotary motion. The crown-wheel ratchet is intermittently rotated by a reciprocating lever carrying a pawl which engages the ratchet teeth.

99. Internal ratchet used on ratchet braces, etc. The drill spindle carries a number of spring-pressed pawls which bear against the internal ratchet teeth formed in the handle of the brace.

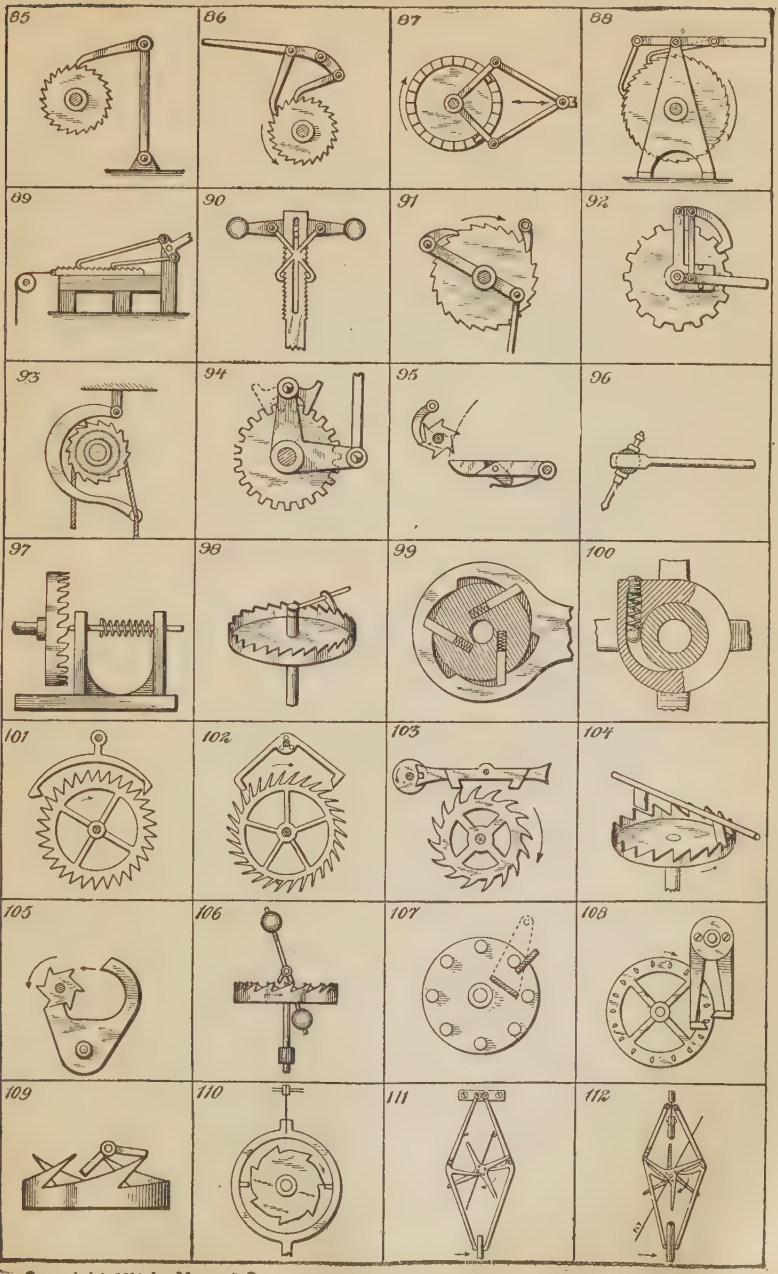
100. Ball ratchet device for lawn mowers, etc. In the hub of a wheel is a groove in which a ball is carried. A spring presses this ball down against a shaft on which the wheel turns. When the wheel rotates forward, the ball wedges in between the shaft and the groove, causing the shaft to turn with the wheel. When the direction of rotation is reversed, the ball is forced up against the spring, releasing the shaft.

ESCAPEMENTS.

101. Recoil Escapement.—This is a common form of escapement used on clocks. The pallets carried by the pendulum are so mounted that when a tooth of the escape wheel, which is driven by the clock-train, is just escaping from one of the pallets, another tooth falls on the other pallet near its point. As the pendulum swings on, however, the taper face of the pallet bearing against the tooth causes the escape wheel to turn slightly backward. As the pendulum swings back, it receives an impulse from the escape wheel which is greater by reason of this recoil. The principal value of the recoil, however, is to overcome any unevenness in the pressure exerted by the train, which might otherwise stop the clock.

102. Dead-beat Escapement.—A form of escapement used on the best clocks. The teeth of the escape wheel fall "dead" upon the pallets, that is, the pallets are so cut that as the pendulum continues to swing they slide on the teeth without turning the escape wheel backward. The ends of the pallets are formed with inclined faces, termed "impulse faces," against which the teeth of the escape wheel bear when giving impulse to the pendulum. The value of this escapement lies in the fact that it gives a very even beat of the pendulum even when there is a slight variation in the force exerted by the clock train.

103. Lever Escapement.—This is an escapement used on watches. The anchor on which the pallets are carried is secured to a lever, formed with a notch in one end. This notch is engaged by a pin on the arbor of the balance wheel. The teeth of the escape wheel alternately bear against the inclined faces of



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the pallets and oscillate the lever, which turns the balance wheel alternately in opposite directions.

104. VERGE ESCAPEMENT.—A form of escapement used in old-fashioned watches. The escape wheel is a crown wheel, and its teeth, on opposite sides, are engaged by two pallets, carried on the shaft of the balance wheel. The escapement teeth, acting alternately on the pallets, lift and clear them, thus rocking the shaft and balance wheel, which governs the frequency of the escape.

105. STAR WHEEL ESCAPEMENT.—The escape has but few teeth and is, therefore, called a star wheel. The pallets act on teeth that lie diametrically opposite each other. This escapement has a dead-beat action.

106. CROWN TOOTH ESCAPEMENT.—An old form of recoil escapement, in which a crown escape wheel is used. The pallets are mounted to engage opposite sides of the wheel. This type is objectionable, owing to the fact that the pendulum must oscillate through a very wide angle in order to permit the teeth to escape from the pallets, which requires a greater pressure in the clock-train and heavier parts and produces greater friction on the pallets.

107. LANTERN WHEEL ESCAPEMENT.—An old-fashioned type of escapement, in which the escape wheel is a lantern wheel, and the pallets are two plates set at angles on a rocking arm.

108. PIN-WHEEL ESCAPEMENT.—A dead-beat escapement used in many of the best turret clocks. The escape wheel is formed with pins which drop on to the "dead" faces of the pallets, but give impulses to the pendulum by sliding off the inclined "impulse" faces of the pallets. It is found best in practice to cut the "dead" faces so as to give a very slight recoil.

109. OLD-FASHIONED CROWN WHEEL ESCAPEMENT.—This, in appearance, is quite similar to the escapement shown in Figure 106, but is different in action. The inclined faces of the teeth, which are very long, act to lift the pallets.

110. RING ESCAPEMENT.—A form of "dead-beat" escapement. The pallets are formed on the inside of the ring, within which the escape wheel turns.

111 and 112. GRAVITY ESCAPEMENTS.—A type of escapement in which the impulse from the escape wheel is not given directly to the pendulum, but through the medium of two weights, usually the arms on which the pallets are carried and which are alternately lifted by the escape wheel and dropped against the pendulum. Figure 111 shows the four-legged gravity escapement used on turret clocks. The escape wheel is formed with four legs or teeth, and carries eight pins, four on one face of the hub and four on the other. The pallet arms are pivoted as near as possible to the point from which the pendulum swings. The pallets which are formed on these arms are arranged to lie one on one side and the other on the other side of the escape wheel. The pallet arms are each provided with a stop piece against which the teeth of the escapement will alternately rest. In the illustration, a tooth of the escape wheel is resting against the stop on the right-hand arm. As the pendulum swings toward the right, the tooth will escape from the stop, permitting the wheel to rotate until it encounters the stop on the left-hand arm, at the same time a pin on the wheel engages the end of the pallet at the left, and lifts the pallet arm. In the meantime the right-hand pallet arm swings with the pendulum to the end of its stroke, but falls with it on the return stroke until stopped by a pin on the escape wheel. It will be evident that the angle through which the pallet arm falls with the pendulum is greater than that through which it is lifted by the pendulum, and it is this difference in travel which gives impulse to the pendulum. Figure 112 shows a double, three-legged escapement which is used for very large clocks. Two three-legged escape wheels are used with three lifting pins held between them like the pins of a lantern wheel. The pallets operate between the wheels. A stop piece is placed on one of the pallet arms for the forward wheel, and the other arm carries a stop for the rear wheel. The teeth of one wheel are set 60 degrees in advance of the other. The action is similar to that of the four-legged escapement. A tooth of the forward wheel is shown resting on its stop. When this is released by the swinging pendulum, the wheels rotate, lifting the left-hand pallet until a tooth of the rear wheel engages its stop. The right pallet arm, however, continues to be lifted by the pendulum, and then falls with it, giving it impulse until arrested by a lifting pin, only to be lifted again when the pendulum releases the rear wheel from its stop.

GEARING.

113. A means for changing rectilinear reciprocating motion to rotary reciprocating motion and vice versa. Two intermeshing pinions engage internal racks formed on opposite sides of a frame.

114. Means for changing rotary motion to rectilinear reciprocating motion. A rotating sector or pinion formed with teeth on only a portion of its periphery imparts reciprocating motion to a rack frame by first engaging the teeth at one side of the rack, and then the teeth on the other side of the rack. See Figure 115 for gravity return.

115. Another method of converting rotary motion into rectilinear reciprocating motion. A rotating sector engages the teeth of a rack during a part of its rotation and thereby lifts the rack, but as soon as the rack clears the sector teeth, it drops by gravity, ready to be lifted up when it again encounters the teeth of the sector. See Figure 114 for power return.

116 A movement designed as a substitute for a crank. The rack frame is formed with internal racks on opposite sides, but these racks lie in different planes. Two separate pinions are employed which mesh respectively with these racks. The pinions are mounted loosely on a shaft, but carry pawls which engage with ratchet wheels secured to the shaft. On the forward stroke of the rack frame the pinions will both be rotated but in opposite directions. However, due to their ratchet and pawl connection with the shaft, only one pinion turns the shaft. On the return stroke the rotation of the pinions will be reversed but the shaft will continue to rotate in the same direction, driven this time by the other pinion of the pair.

117. Sun and Planet gearing. A gear wheel, called the "sun" wheel, rotating on a fixed center, is engaged by a gear wheel called

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the planet wheel, which revolves about the sun wheel. This construction was used by James Watt in one of his steam engines as a substitute for a crank. The planet wheel was rigidly secured to the connecting rod and connected by an arm to the center of the sun wheel. At each complete revolution of the planet wheel about the sun wheel, the latter was caused to rotate twice.

118 and 119. Means for converting rotary motion into irregular reciprocal motion. In 118 two intermeshing spur gears are provided with crank arms connected by a working beam. If the gears are of equal size the motion transmitted to the rod secured to the working beam will be uniform. If, however, the gears are of different sizes, the motion of this rod will vary greatly. In 119 a still more complex movement is produced, since there are three intermeshing gear wheels of unequal sizes and two connected working beams.

120. Irregular oscillatory motion is given to a hinged arm by pivoting at its outer end a cam-shaped gear wheel which is rotated by a continuously driven pinion. Any desired motion of the arm may be produced by varying the shape of the cam gear.

121. Means for converting uniform rotary motion into variable rotary motion. An elliptical gear rotates at uniform speed and drives a spur pinion. The latter is secured to a shaft which slides between the arms of two forked levers. A spring keeps the pinion in mesh with the elliptical gear.

122. Means for converting constant rotary motion into intermittent rotary motion. The driving wheel is formed with teeth through a portion of its periphery equal to the toothed periphery of the pinion. The latter is cut away at one place to fit the plane portion of the driving wheel. This prevents the pinion from rotating until a pin on the wheel strikes a projecting arm on the pinion and guides the teeth of the gears into mesh with each other.

123. Means for converting uniform rotary motion into variable rotary motion. A crown wheel eccentrically mounted is driven by a pinion rotating at uniform speed. The point of engagement of the crown wheel with the pinion varies radially, causing the wheel to rotate at a variable speed.

124. The mechanism is so arranged as to impart planetary movement to a pinion. An internal gear wheel formed with a pulley groove in its periphery is mounted to rotate on a sleeve which carries a spur gear at one end and a pulley at the other. The gear wheels are belted to a driving pulley in such manner as to rotate in opposite directions. A spur pinion which fits in between the teeth of the two gears is rotated thereby on its own axis and revolves about the center of the two gears at a speed which is the differential of the speeds of the two gears.

125. The construction here shown is adapted to produce a slow forward movement of a rack with a quick return. The rack is mounted to slide longitudinally and is driven by a toothed sector. The latter is provided with a slotted arm which is engaged by a pin on a rotating disk. The forward movement will take place while the pin is passing through the larger arc subtended by the two dotted radial lines shown, and there turn while the pin is passing through the smaller arc.

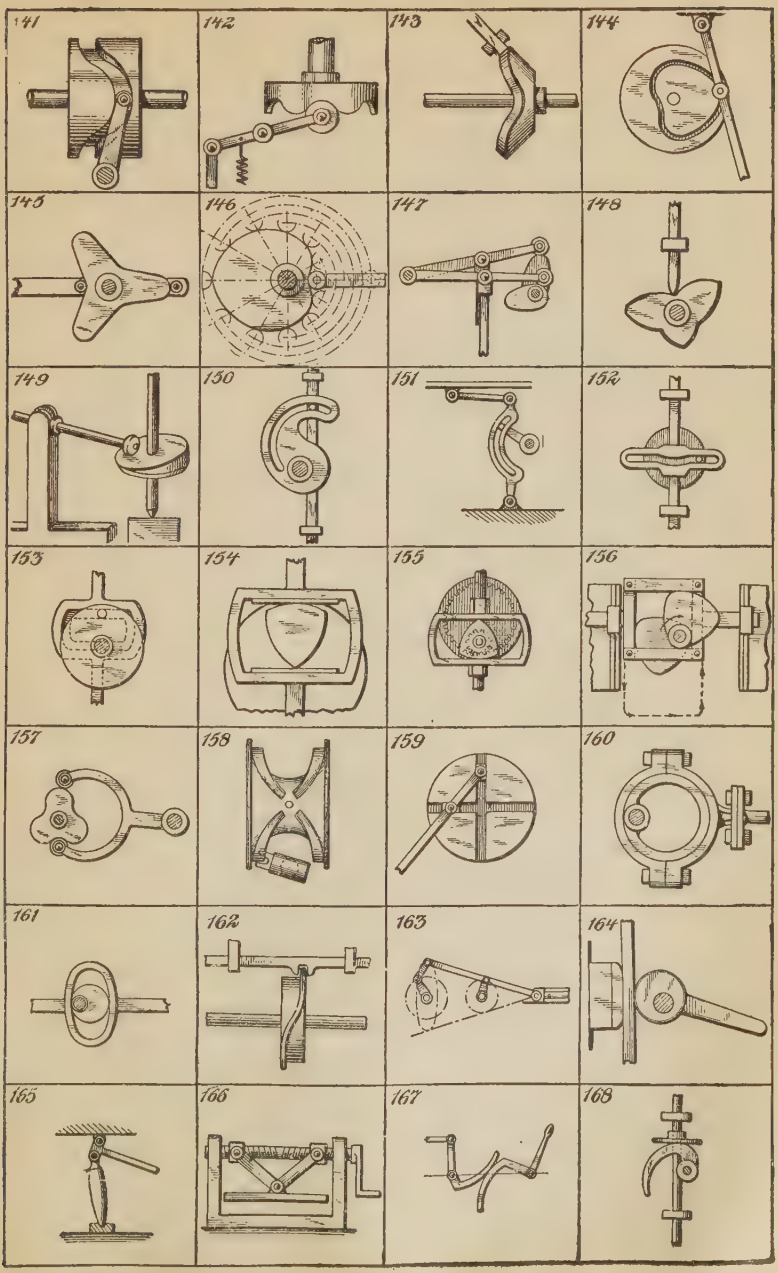
126. A means for converting reciprocating motion into continuous rotary motion. A double-faced reciprocating rack engages first one and then the other of a pair of toothed sectors. The sectors are mounted on a pair of shafts, disposed on opposite sides of the rack. The shafts carry pinions which engage opposite sides of the central gear wheel. The rotary motion alternately imparted to the sectors, is conveyed through these pinions to the gear wheel, each pinion alternately acting to drive the wheel when its respective sector is in mesh with the rack, and then to be driven by the gear wheel until its sector is brought again in mesh with the rack. Thus a continuous rotary motion is produced.

127 Mechanism for converting uniform rotary motion into irregular rotary motion. Mounted eccentrically on the driving shaft is a gear wheel which transmits motion to another gear wheel through an intermediate pinion. Pivoted to the centers of the two gear wheels are two links whose outer ends are connected by a hinge pin on which the pinion rotates These links serve to hold the pinion constantly in mesh with the gears, no matter what the position of the eccentric is.

128. Means for converting uniform rotary motion into variable reciprocating motion. A rack frame mounted to slide longitudinally is driven by an eccentric-toothed sector. The racks are placed at an angle with the line of movement and are provided with jaws at each end adapted to mesh with pins projecting above the face of the sector. As the sector rotates it transmits a gradually accelerated longitudinal movement to the rack frame until the outer pin engages the jaw at the end of the rack. The rack frame is then driven by this pin until the opposite rack is engaged by the sector teeth.

129 to 132. MANGLE GEARS.—So-called because of their use on mangle machines. 129. The larger wheel is formed with a cam groove which guides the pinion. The shaft of the latter is ordinarily provided with a universal joint, which permits it to move vertically and thus keep in mesh with the crown teeth formed on the large wheel. The pinion meshes first with the outer and then with the inner ends of the teeth on the larger gear, driving the latter first in one direction and then in the other. 130 shows another form of the same movement. The pinion moves radially in the slot shown in dotted lines, and engages first the outer and then the inner line of teeth on the mangle wheel, causing the latter to rotate first in one direction and then in the other. 131. The mangle wheel is formed with an internal gear, and the pinion is guided by a cam groove. This construction and that shown in Figure 130 produce uniform motion through an almost complete rotation, and this is followed by a quick return due to the smaller radius of the inner circle of teeth. 132. In this construction, as in that of Figure 129, the same speed is maintained in both directions of rotation. The mangle wheel in Figure 132 is formed with teeth on both faces; the pinion first engages the teeth on one face of the wheel, and then passing through the opening engages the teeth on the opposite face, thus reversing the direction of rotation.

133 to 137. DIFFERENTIAL GEAR.—133. Two worm wheels, one of which has more teeth than the other, engage a single worm. Suppose that one wheel has 100 teeth and the other has 101; then at every complete rota-



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tion of the latter wheel it will be one tooth behind the former wheel, and at the end of 100 rotations the former would have made a complete rotation relative to the latter. If the worm be cut with a single thread it would have to make 100 times 101, or 10,100 rotations in order to produce this result. This construction is used on certain counting devices.

134. Two bevel gears are connected by a pair of small bevel pinions mounted in a frame, as shown in the side elevation I. If the gear wheels should be rotated at different velocities the frame would rotate at the mean velocity.

135. A rapidly rotating shaft carries a gear wheel eccentrically mounted thereon. The latter is carried along into engagement with a fixed internal gear or rack, and is thereby rotated at a slow speed.

136. Two concentrically mounted bevel gears of different diameters engage with a third bevel gear. The latter rotates at the mean of the velocities of the other two.

137. A hollow screw threaded into a frame is formed with an internal thread, of slightly different pitch, adapted to receive a smaller screw, which is so mounted in the frame that it may slide longitudinally, but cannot rotate. If the larger screw should have ten threads to the inch, and the smaller screw eleven, the latter would move outward one-eleventh part of an inch while the former was fed inward an inch.

138. Uniform rotary motion converted into reciprocating rectilinear motion. A rack frame arranged to slide longitudinally is engaged by a toothed sector which meshes with the teeth on one side of the rack to drive the frame forward, and then with the teeth on the other side to drive the frame back.

139. Variable speed gear for producing fast and slow motion. It comprises two pairs of toothed sectors so arranged as to properly mesh with each other. The driving gear shown at the right is provided with two arms which carry studs at their outer ends. These studs lie below the lower face of the gears and engage studs formed on the lower face of the driven gear, as shown in dotted lines, thus guiding the wheels after one pair of sectors have moved out of mesh and before the other pair have come into mesh with each other.

140. Mechanism for producing increased or decreased speed on the same line of shafting. A fixed bevel gear wheel, *A*, meshes with two bevel gear wheels, *B*, which in turn mesh with a pinion, *E*, carried on the right-hand shaft. The bevel wheels, *B*, are mounted in a bracket which turns freely on the shaft of pinion, *E*. Each wheel, *B*, carries a pinion, *C*, which meshes with a bevel gear wheel, *D*, carried by the left-hand shaft. The change of speed from one shaft to the other is due to the planetary movement of the wheels, *B* and *C*. When the multiple of the teeth in *A* and *C* exceeds that of *B* and *D* the shafts will rotate in opposite directions.

CAMS AND CAM MOVEMENTS.

141 and 142. Cylinder or Drum Cams.—In Figure 141 a groove is formed in the curved face of a cylinder or drum. A roller on the end of a pivoted arm fits into this groove. As the drum rotates the arm will be swung to various positions, guided by the groove in the cam. In Figure 142 the roller bears against the rim of the cylinder, which is made of such shape as to give the desired motion to the lever. In this form of cam, while the roller is positively moved down by the cam rim, it is raised up by a spring on the lever, which tends to hold it constantly against the cam. In the first type of cam the motion is positive in both directions.

143. Beveled Cam.—This form of cam is used to give motion to a lever whose axis lies at an angle with the cam-shaft. The cam is of conical form with curved edges against which the lever bears. In our illustration we have shown a sliding rod in place of a rocking lever. The conical face, it will readily be seen, must lie parallel with the plane of the rod.

144. Face Cam.—The cam groove is cut in the face of a disk, and this on being rotated guides the movement of the rocking lever which carries a roller that enters this groove.

145. Clover-leaf Cam.—This is a form of disk cam which gives a positive drive to a sliding lever. The cam acts between two rollers on the lever, and is so cut as to exactly fill the space between these rollers at all times.

146. Heart Cam.—Another form of disk cam. This is so cut as to give uniform rectilinear motion to a sliding rod which bears against its edge. To lay out this cam, divide the desired line of travel of the rod into any convenient number of equal spaces, starting from the center of the roller, and from the center of the cam describe arcs passing through the dividing points. Twice the number of radial lines should be laid off from the center of the cam, the lines being equally spaced angularly. The successive points of intersection of the radial lines and the arcs will then mark the centers for a series of arcs with radii equivalent to the radius of the roller. The curve drawn tangent to these arcs will then mark the outline of the cam.

147. Means are here shown for converting rotary motion into alternating reciprocating motion of two rods. The rods are attached to pivoted levers carrying rollers which bear against the edges of two oval disk cams mounted on a rotating shaft.

148. Rotary motion is here converted into variable rectilinear motion. The end of a sliding lever rests on the irregular edge of a disk cam, and is there by caused to move up and down following the irregularities of the cam. The cam shown gives three reciprocations of the rod for each rotation of the cam shaft.

149. Means for converting rotary motion of a shaft into rocking motion of a lever. The lever is caused to rock by a cam with an oblique face on which the roller of the lever bears. This is a modification of the motion shown in Figure 142.

150. Means for converting rocking motion of a shaft into uniform rectilinear motion of a rod. The rod, which is mounted to slide in bearings, carries a pin which engages a slot in the cam on the rocking shaft. The cam slot is so cut as to give uniform motion to the rod.

151. Continuous rotary motion of a shaft is here converted into intermittent reciprocating motion of a slide. A cam lever hinged at its lower end to a fixed point is connected by a rod at its upper end, to the slide. A crank arm on the rotating shaft carries a pin which enters a curved slot in the cam lever. The crank arm causes the lever to rock, carrying the slide with it. The cam slot should form an arc with a radius equal to that of the crank arm, so that while the crank pin is passing

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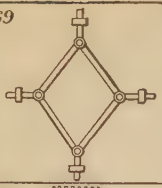

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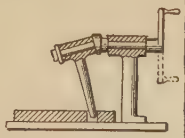

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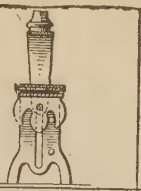

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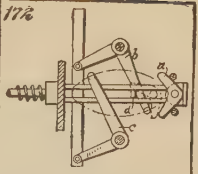

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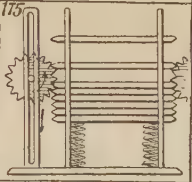

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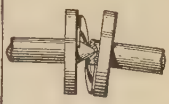

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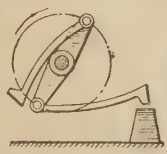

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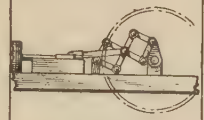

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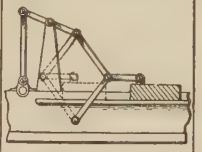

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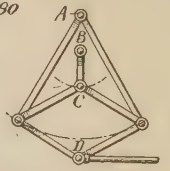

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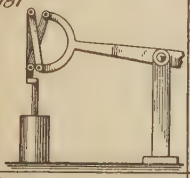

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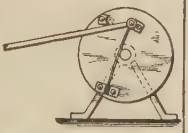

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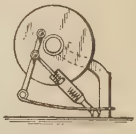

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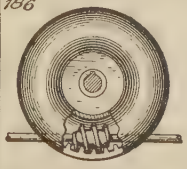

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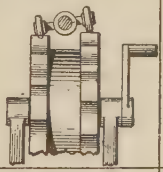

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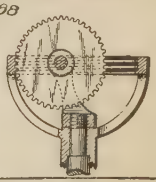

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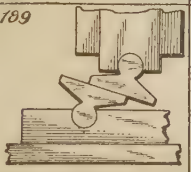

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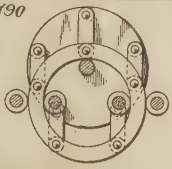

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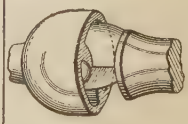

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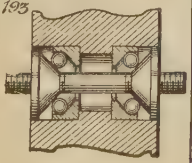

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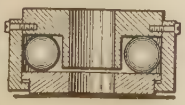

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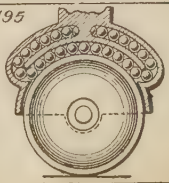

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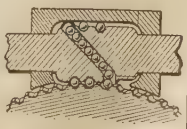

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through this arc the slide will remain stationary. This motion is used on certain types of sewing machines and printing presses.

152. The type of cam used on the needle bars of some sewing machines. A pin on a rotating disk engages a slot in a cam yoke on the needle bar. This slot is formed with a curve at one place, which holds the bar stationary, while the pin is passing through it. This causes the needle to stop while the shuttle passes.

153. This cam motion differs from that of Figure 152, in that it causes the sliding bar to stop midway of its upward stroke and midway of its downward stroke. The cam slot comprises two parallel sections connected by two curved sections. While the pin on the rotating disk passes through the curved sections the bar is held stationary.

154. The cam here shown causes the sliding bar to stop at the end of each stroke. The cam is triangular, with curved faces, and rotates between the two parallel working faces of a cam frame on the sliding bar. While the outer face of the cam engages the frame the bar is held stationary. This is a form of cam motion used in place of an eccentric for operating the valve of a certain French engine.

155. A peculiar variable intermittent motion of the sliding rod is given by the planetary action of a cam mounted on a rotating disk. The cam shaft passes through the disk and carries a pinion which meshes with a stationary internal gear wheel.

156. A rectangular motion is imparted to the cam frame by two triangular curved cams mounted on a rotating shaft. The frame is mounted to slide laterally in bearings, which in turn are permitted to slide vertically in grooves on two stationary supports. The frame is made up of two horizontal rails on which one of the cams acts, and two vertical rails on which the other cam acts The illustration shows the frame about to be moved downward by the forward cam acting on the lower rail while the rear cam prevents any lateral movement. On the next quarter rotation of the cam shafts a lateral movement will ensue, due to the rear cam acting on the right-hand vertical rail. At the same time the forward cam will hold the frame against vertical movement. During the third quarter of the rotation the frame will be lifted, and during the last quarter it will be moved back laterally to the position illustrated. If the cams are both of the same size, the motion of the frame will trace a perfect square.

157. Means for converting rotary motion into vibrating motion. A forked lever engages opposite edges of a disk cam, and is thereby caused to vibrate. This cam, as that in Figure 145, is so cut that its opposite edges are everywhere equidistant when measured through the center. For this reason it is obvious that such a cam must always be cut with an odd number of projections.

158. A recently patented mechanism for imparting power to the dasher shaft of a churn. A rocking movement is imparted to the shaft from a rotating cam. At the upper end of the shaft is a forked piece or follower mounted to turn in a socket at right angles to the axis of the shaft. The follower engages a spline on the cam and is thereby guided first to one side, and then to the other of the cam, rocking the shaft on its axis.

159. Trammel Gear.—A reciprocating movement of the rod is produced by the rotation of a shaft, and *vice versa*. Pivoted to the rod are two blocks which slide respectively in two slots in the face of the disk which cross each other at right angles. This movement was patented seventy years ago, but is constantly being reinvented as a substitute for the crank.

160. Mechanism for converting rotary motion into reciprocating motion. This is a common form of eccentric used on steam engines, etc., for communicating a reciprocating motion to the valves from the crank shaft. The rod is provided with a circular strap which is bolted over a disk or ring eccentrically mounted on the crank shaft.

161. This form of eccentric is similar to that shown in Figure 160, but an oval cam frame or yoke is used in place of a circular strap, so as to produce a rectilinear reciprocating movement of the rod. This form of eccentric acts directly on the valve rod which travels between fixed guides.

162. Spiral Cam for converting rotary motion into reciprocating motion. The cam is formed with a flange or spline, disposed spirally on the curved face of the wheel. The spline engages a notch in a rod and gives the latter a reciprocating movement when the cam is rotated.

163. Elliptical Crank.—Two cranks are connected with a single pitman, the outer one, through a connecting link. The circular movement of the inner crank causes the outer end of the pitman to move in an elliptical orbit, thereby increasing its leverage at certain points.

164. A device for gripping a bar or cable. The bar travels between a fixed guide and the cam-shaped head of a lever. When the lever is thrown up, friction of the bar on the cam tends to rotate the latter until it becomes wedged between the cam and the fixed guide

165. Lever Toggle-joint.—A device commonly used on letter-presses. One of the two connected arms is pivoted to the platen of the press and the other is hinged to a fixed standard. By lifting the lever on one of the toggle arms the arms will be brought into vertical alignment with each other, producing a powerful pressure on the platen.

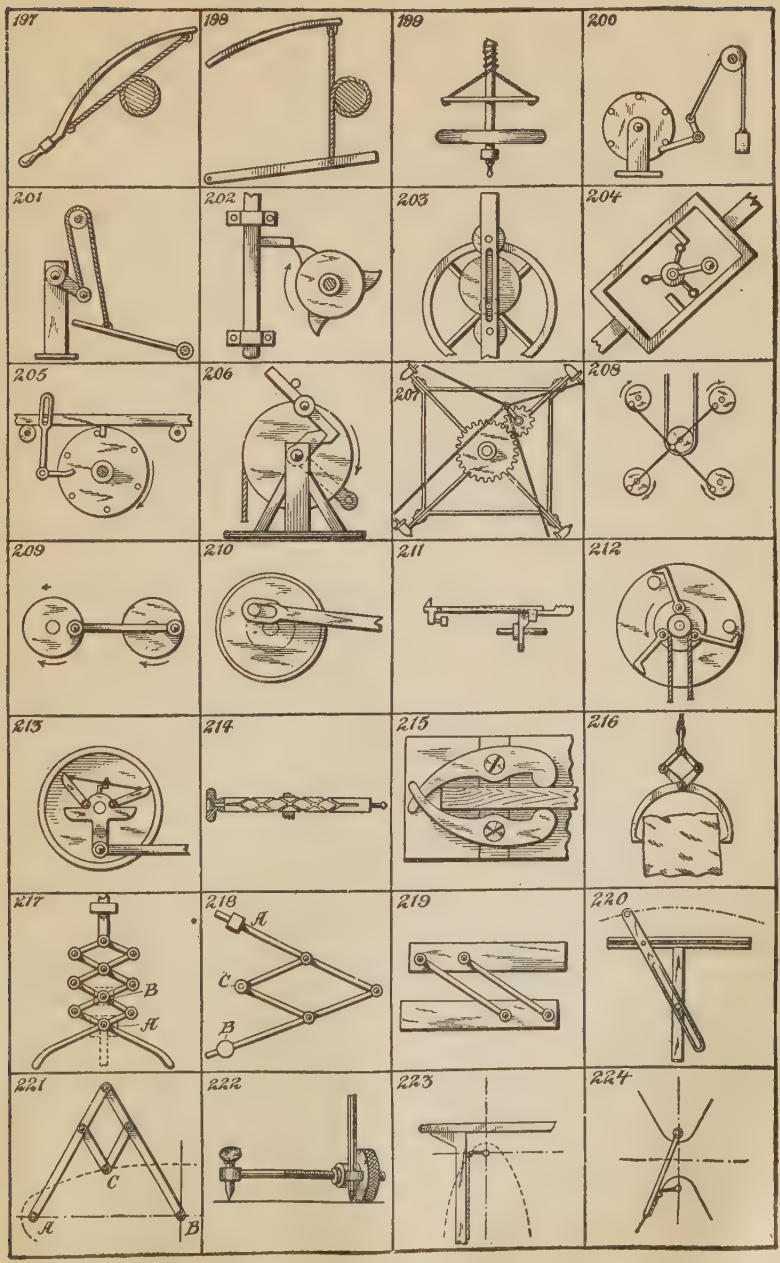
166. Screw Toggle Press.—Two toggle arms are hinged to the letter-press and at their outer ends are hinged to nuts on the feed screw. The screw is cut with right- and left-hand threads. so that when turned in operative direction it will draw the arms toward each other and press the platen downward.

167. Bell Crank Toe Levers.—Two bell crank levers are provided with projecting toes which bear against each other When one of these levers is swung on a center it causes the other to swing also, but at a variable speed, due to the varying leverage. This mechanism is used for a type of valve gear.

168. Wiper Cam.—A type of cam used on certain stamp mills to lift the hammer. The cam bears against a flanged collar on the hammer spindle, which permits the latter to rotate.

MISCELLANEOUS MOVEMENTS.

169. Device for transmitting reciprocating motion from one pair of rods to another pair lying at right angles thereto. The rods are all connected by links so that when two opposed rods are moved inward or toward each



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other, the other two rods will be moved outward, and *vice versa*. Also if two adjacent rods be moved the one outward, and the other inward, the opposite rods will be moved one outward and the other inward respectively.

170. Means for converting rotary into reciprocating motion. A bent shaft carries at its outer end an arm which is loosely mounted thereon. The lower end of this arm engages a slot in a bar which is mounted to slide in suitable guides. As the bent shaft rotates, the arm which is prevented from rotating with the shaft is given a rocking movement in the direction of its axis, and thus imparts a reciprocating movement to the bar.

171. Movement used on hand stamps. The plate which carries the type normally lies face upward against an ink pad, and is formed with a flange at each end in which cam slots are cut. The type plate is pivoted in a yoke piece to which the handle is secured, the pivot pins passing through slots in the uprights of the frame. When the handle is depressed, the type plate is carried downward and at the same time rotated by engagement with two pins which operate in the cam slots so that the type will face downward when brought into contact with the paper. The parts are returned to normal position by a spring on release of the handle.

172. A peculiar device for alternately rocking a pair of levers by means of a reciprocating rod. The rod carries a bell crank lever, *A*. This lever is normally held in the position illustrated by two pins against which it is pressed by the spring-pressed rod. Two bell crank levers, *B* and *C*, connected by a bar, are hinged adjacent to the rod. With the parts in the position illustrated, when the rod is drawn forward, one arm of the bell crank, *A*, will engage a pin at the end of lever, *B*, and will be thereby turned until it engages a stop piece, *D*, on the rod, after which it will operate to swing bell crank, *B*, on its axis. Owing to the connection between the levers *B* and *C*, the latter will also be swung but in the opposite direction. On return of the rod the bell crank lever, *A*, is brought to normal position by the two position pins, and when next the rod is drawn forward, the other arm of lever *A* will engage a pin on lever *C*, returning both levers *B* and *C* to their original positions.

173. Mechanism for transmitting rotary motion at increased speed from one shaft to another in alignment therewith. The lower or driving shaft carries a crown wheel at its upper end which is engaged by a second crown wheel having universal joint connection with a stationary central post. The latter is supported from the frame by cross arms, which are adapted to engage slots cut in the second crown wheel, and thus prevent the wheel from rotating. The upwardly projecting frame of the second crown wheel is connected to a wheel on the upper shaft, but eccentric thereto, by means of a ball-and-socket joint. The driven crown wheel is thus tilted so as to engage the teeth of the driving wheel. As the latter rotates the driven wheel is given a rocking or wobbling movement, which rotates the upper shaft. A slight movement of the lower shaft thus produces a complete rotation of the upper shaft.

174. A device for converting reciprocating into rotary motion and *vice versa*. Two intermeshing gear wheels are provided with spring pawls oppositely disposed on the gears, and adapted alternately to snap into engagement with a lug on a reciprocating rod and thereby impart rotary motion to the gears.

175. A device for spacing apart a number of bars. The bars are arranged to slide with a certain amount of friction between guide pieces. Normally they are crowded together in a group by a pair of coil springs. A pair of rotating spur wheels whose teeth engage the pointed ends of the bars are mounted on either side to slide vertically in suitable guideways. The vertical movement of the gears carries the bars downward against the springs and the slow rotary movement of the gears successively releases the bars at regular intervals. The bars remain where released, being held by frictional engagement with the guide pieces.

176. An early form of flexible shaft coupling. One of the shafts is pointed and fits into a socket in the other shaft. Each shaft carries a collar and these are connected by a flat spiral spring.

177. Centrifugal hammer. Two hammers are hinged on a rapidly revolving disk. As the disk revolves, these hammers are alternately swung by the added force of gravity and of centrifugal action, on to the anvil. A very powerful stroke is thus given.

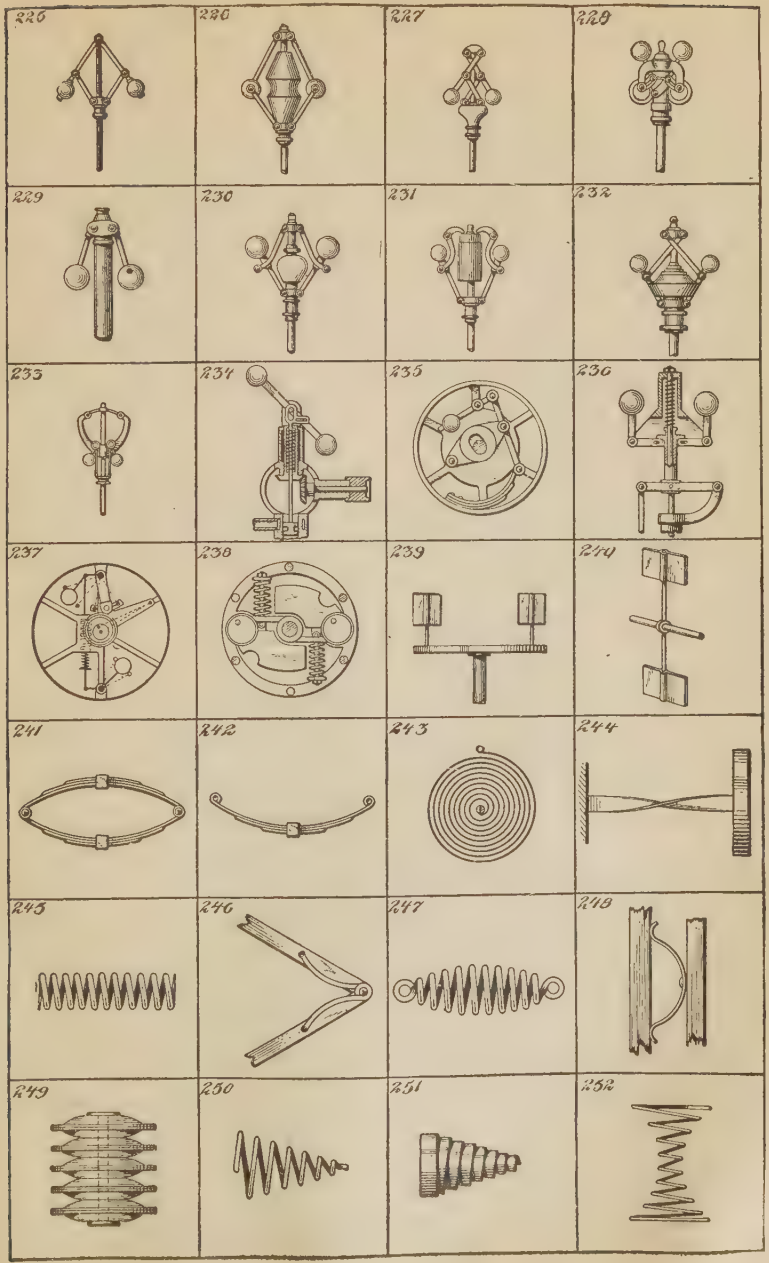
178. A device for communicating reciprocating motion of an engine to a rotating crank in such manner that the crank will have a greater throw than the stroke of the engine crosshead. The connecting rod acts on the crank shaft through a "lazy tongs" which multiplies the stroke and affords a better leverage upon the same.

179. A device for producing two rotations of the crank shaft of an engine at each complete (forward and return) stroke of the crosshead. The crosshead of the engine is connected by a rod to a pair of connected levers, one of which is pivoted on a fixed pin and the other to the working beam. Owing to the toggle action of the levers the working beam will rise and fall twice while the crosshead moves to its outer position and returns.

180. A device for converting rocking movement into rectilinear reciprocating movement, usually called "parallel" motion. Two links pivoted on the fixed pin *A* connect at their outer ends with two links pivoted on a rod at *D*. The latter links are also connected to a pair of links pivoted to a rock arm *C*. The distance between *A* and *B*, the fixed pivot of the rock arm, is equal to the distance between *B* and *C*. Owing to the fact that the double link-quadrangle swings on two pivots, it will be lengthened when swung out of the vertical position, thus giving a rectilinear motion to the rod *D*. This movement is called "Peaucellier's" parallel motion. It is used to give rectilinear movement to a pump rod or to the piston rod of an engine.

181. Another device for producing rectilinear movement of a pump rod. The rod, instead of being directly connected to the working beam of an engine, is connected thereto by cross links. This motion, however, is not a true "parallel motion," but the rod is strained by cross connection.

182 to 184. Devices for overcoming "dead" centers of cranks. In Figure 182 the pitman is connected to one end of a leaf spring, whose other end is connected to the crank disk. The



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pitman is thus permitted to play between two socket lugs projecting from the face of the disk. Just before the back center is reached, the pitman slips out of engagement with the lower socket, by reason of the tensile strain on the spring, then on the return stroke, the connection of the spring being above the line of centers, the spring yields and throws the pitman back into the lower socket, and acts upon it to rotate the disk, until the forward center is reached, when the action will be the reverse of that just described. In 183 the pitman is attached to a plate secured to the flywheel at two points by screws passing through slots cut diagonally in the plate. In starting the wheel from either of its dead centers, the pitman will cause the plate to slide on its diagonal slots and the pitman will thus carry itself out of the dead center. The plate will then be returned to normal position by a spring. The device shown in 184 is specially applicable to machines operated by treadles. Attached to the pitman is a piston acting in a cylinder pivoted to the rod on which the treadle is hinged. Within the cylinder are two coil springs which alternately act on the piston to carry the crank over the two dead centers.

185. A device for transmitting motion from one shaft to another lying at right angles thereto. The driving shaft is formed with a spiral ribbon which acts between rollers radially mounted on a wheel, carried by the driven shaft. The wheel is formed with a double series of rollers, one on each side of the spiral shaft, but the forward series has been cut away in the illustration to show detail. The action is similar to that of a worm and worm wheel, but friction is reduced by the use of the rollers.

186. An internal worm gear is here shown which offers the same advantages as the internal spur gear, namely, that of greater strength due to the fact that the area of contact between the worm and the worm wheel is increased. The worm wheel is made up of two hollow sections, clamped together, but so spaced as to form a slot in the rim through which the worm shaft passes.

187. Means for converting rotary motion into rocking motion. The power shaft carries two cams formed with corrugated peripheries. On opposite sides of the rock shaft are two rollers, one for each cam. The cams are so spaced that when one roller is being lifted, the other will fall. Thus, a rocking motion is imparted to the rock shaft. The same effect may be produced by using a single broad cam for the two rollers, but spacing one roller a little in advance of the other on the rock shaft.

188. Another form of internal worm gear. A worm wheel is mounted on a stationary bracket and engages the spiral thread formed in a ring. As the ring revolves about the gear, the latter is caused to slowly rotate. As in Figure 186, a very strong construction and powerful transmission is afforded by this arrangement

189. A sliding toggle movement is here shown for producing great pressure in a direction at right angles to that of the impelling force. The toggle members are so mounted and are of such shape that they combine the action of the inclined plane with the ordinary toggle action,

190. Means for giving parallel movement to the paddles of steamboats, etc. The power shaft carries a disk which is connected by a series of hinged links with a ring held eccentrically to the shaft, between pairs of rollers. The paddles are attached to the links and are thereby kept parallel, while the disk and ring rotate. This same arrangement can be used to communicate motion to shafts lying out of alignment with each other, one of the shafts being attached to the ring.

191. Device for transmitting motion from one shaft to another at decreased velocity. The device is here shown diagrammatically. The driving shaft carries an eccentric *A*, upon which spur gears *B* and *C* are fitted to turn freely. The latter are permanently secured together. Wheel *B* meshes with internal gear *D*, on the driven shaft, and wheel *C* meshes with the stationary internal gear *E*. In operation the eccentric carries gear *C* about gear *E*, thereby causing it to rotate on its own center. The gear *B* will be revolved by the eccentric in one direction and be rotated in the opposite direction by the gear *C* to which it is attached, thus causing the gear *D* to move at a reduced speed,

192 to 196. BALL-BEARING DEVICES.—In 192 is shown a ball-bearing knuckle joint consisting of a flanged socket member having sockets for the reception of steel friction balls, and a second member formed with flanges which bear against the friction balls. When the device is in operation, the balls will roll back and forth in their sockets at each rotation of the knuckle joint. In 193 a common form of ball-bearing is shown. The balls are held in stationary cups and bear against cones on the rotating shaft. 194 shows an end-thrust ball bearing of common form. 195 shows a ball-bearing wheel or caster. The balls are arranged to travel over an endless path, being guided from the forward end of the wheel bearing, through a passageway in the body of the caster, to the rear of the wheel bearing surface. 196 shows the same principle applied to a worm and worm wheel. The thread of the worm does not engage the teeth of the worm wheel, but communicates motion thereto through a series of balls. The latter, when they reach the end of the worm thread, are guided back through a passageway in the worm body to the beginning of the thread.

197. Means for converting reciprocating rectilinear movement into reciprocating rotary movement. A primitive form of turning lathe. The wooden shaft or other object to be turned, is mounted to rotate freely between pivot pins. A rope coiled about the shaft has its free ends secured to a spring bow. In operation, the handle of the bow is seized in one hand, and the other hand holds the tool against the work, which is rotated first in one direction, and then in the other, by moving the bow back and forth.

198. This is another form of primitive lathe which, however, is adapted to be driven by foot power. The rope, which is wound around the shaft is secured at its upper end to a spring, usuelly the end of a thin board, and at its lower end to a pedal. When the latter is depressed, the shaft will rotate toward the cutting tool and on its release the spring will cause it to rotate back, ready for the next downward stroke of the pedal. This type of

lathe is still commonly used in some Eastern countries.

199. An ancient form of drill, but one which is still used by jewelers. Coiled about the spindle of the drill are two cords whose lower ends are secured to a cross piece mounted to slide up and down on the spindle. When the cross piece is pressed downward, it causes the cords to uncoil, rotating the spindle. When the cross piece reaches the bottom of its stroke the pressure on it is relieved, and due to the momentum of a heavy flywheel on the spindle, the latter continues to rotate, recoiling the cords and lifting up the cross piece. On the next downward stroke of the cross piece, the spindle will rotate in the opposite direction.

200. Trip hammer. A rotating disk is formed with a series of pins adapted consecutively to depress one arm of a bell crank to the opposite arm of which a hammer weight is connected by a cord. When the bell crank clears a pin on the disk, the weight drops, delivering the blow, and is then lifted again by the next pin acting on the bell crank.

201. Means for converting reciprocating motion into rotary motion. A rope attached at one end to a foot pedal passes over an intermediate pulley, and is attached at the other end to the weighted crank arm of a shaft. The arrangement is such that on the downward or power stroke of the pedal, the weighted arm will be lifted to the vertical position, when it will be assisted by gravity and its own momentum to continue its rotation and lift the pedal for the next downward stroke.

202 to 205. Means for converting rotary motion into rectilinear motion. In 202, secured to a rotating shaft is a cam formed with projecting horns, which are adapted to successively engage a lug on a sliding rod. The rod is thereby given a trip-hammer movement, dropping by gravity as the lug clears the horns. In 203, a disk mounted eccentrically on a rotating shaft is engaged on opposite sides by a pair of rollers, pivoted to a rod. As the shaft rotates, the rod will be moved up and down, following the eccentric movement of the disk. This movement is used on windmills to transmit motion from the rotating windmill shaft to the pump rod. In 204 a shaft is provided with radial arms bearing rollers at their outer ends. These are adapted to operate within a frame mounted to slide, and formed with two lugs diagonally disposed on opposite sides of the frame. When the shaft is rotated, by means of the crank arm shown, the frame will be moved first to one side by one of the rollers engaging one of the lugs, and then in the opposite direction by another of the rollers moving into engagement with the other lug. In 205, a sliding carriage is formed with a lug adapted to be engaged successively by a series of pins on a revolving disk. The carriage will be moved forward by one of the pins until the latter clears the lug, when the carriage will be moved back again by another pin engaging an arm of a bell crank whose other arm engages the carriage.

206. Automatic release for a winding drum. A winding drum is mounted to turn freely on a shaft. A hook is pivoted on the face of the drum, and when it is desired to rotate the drum the hook is brought into engagement with a tappet on the shaft. When, however, the weight has been raised to a predetermined position by the winding drum, a pin strikes the hook, releasing it from engagement with the tappet and permitting the weight to drop.

207. An amusement device called the "Flying Horse" used in parks and fairs. A frame mounted to rotate on a vertical spindle, is provided with a simple gear wheel, which meshes with a driving pinion. By alternately pulling the cords, radiating from a crank on the shaft which carries the pinion, the persons occupying the seats or horses at the corners of the frame, are enabled to keep the apparatus in motion.

208. This figure shows a single pulley driving four other pulleys by means of a cross-shaped connecting rod. This form of drive is occasionally used for rotating wheels or cylinders which lie so close to each other that no gearing or other mechanism for transmitting motion can be used.

209. This figure illustrates the rather curious fact that if two wheels are coupled together by a connecting rod, whose crank pins are respectively equally distant from the centers of the wheels, then while one wheel is constantly rotated in one direction the other may be rotated in the same direction, or in the opposite direction, as desired.

210. A stop motion used in brick machines for drawing the mold back and forth, and bringing it to rest at each stroke to permit of depositing the clay and removing the brick. A rotating wheel carries a crank pin which engages a slot in a connecting rod. At the end of its forward stroke, and at the end of its return stroke the connecting rod will remain stationary, while the crank pin moves from one end of the slot to the other.

211. A device used in sewing machines for feeding the goods under the needle. The feed bar is formed with teeth at one end and the opposite end is pivoted between the arms of a forked lever. The feed bar is lifted by a peripheral projection on a cam, and at the same time the forked lever is moved forward by a projection on the side face of the cam, which bears against a lug carried on the lever. A spring at the opposite end of the lever normally holds the lug in contact with the face of the cam.

212. Elevator safety device. Secured to the side of the elevator shaft is a plate formed with one or more studs. To the winding drum of the elevator a number of hooks are pivoted. When the drum rotates the hooks are thrown out by centrifugal action, and if dangerous speed is acquired, they swing out far enough to catch hold of one or more of the studs, bringing the drum to a stop. The shock of the sudden stoppage is usually taken up by a coil spring on the drum.

213. A device for converting oscillating motion of a lever into intermittent rotary motion. A crank arm which is provided with two pawls hinged to its upper end, is oscillated within the rim of a wheel. The pawls are connected by a cord to a small crank, which may be turned so as to bring one pawl into frictional engagement with the rim of the wheel, and thereby cause the wheel to rotate intermittently. When it is desired to reverse the direction of rotation, the crank is turned, raising the first pawl and bringing the other one into engagement with the wheel.

214. Means for converting rectilinear motion into rotary motion. This is used on certain forms of drill stocks. The drill stock is cut with two spiral grooves, one of which

is left-handed and the other right-handed. A ring on the drill stock is provided with a follower which follows one of the grooves on the forward stroke, and the other groove on the return stroke, thus causing the drill to turn always in the same direction.

215. An automatic bench clamp, used by carpenters for holding the work while planing, etc. Pivoted to the work bench are two cam levers, formed with curved ends, which are moved apart by the work as it is pressed in between them, thus causing the clamping ends of the levers to tightly grip the work.

216. Gripping tongs for lifting stones and the like. The upper arms are connected to a shackle by a pair of links so that when a pull is exerted on the shackle, the arms are drawn together, pressing the points into the stone; the heavier the stone lifted the more tightly will the arms be drawn together, thus increasing the grip on the stone.

217. A series of cross connected levers used for multiplying or reducing motion. In the illustration, the lowest pair of levers is pivoted to a fixed pin *A*, and the arrangement is such that if one pair of the crossed levers be folded together, the entire series will fold, giving the rod attached to the upper pair of levers a greatly multiplied longitudinal movement, and conversely if the rod be moved, a greatly reduced motion will be given to the lower pair of links. The extent to which the motion is multiplied or reduced is directly proportional to the number of pairs of levers in the series. This device is called a "lazy tongs." The figure also shows a means for multiplying motion imparted from one rectilinear reciprocating rod to another. If the fixed pivot of the lazy tongs be at *B*, on giving reciprocating motion to the lower rod, the reciprocating motion will be imparted to the upper rod, but the travel of the upper rod will be twice that of the lower rod.

DRAFTING DEVICES.

218. A pantograph, or an instrument for reproducing a drawing on a larger or smaller scale. It comprises two levers hinged together and connected by a pair of hinged links. One of the levers carries a slide, *A*, in which a pencil is secured. The other lever carries a pivot pin, and the tracing point is located at *C*. In use the device is made to turn on the fixed point at *B*, then on moving the tracing point *C* over a drawing, the same will be reproduced by the pencil at *A*. By varying the positions of the pencil and the pivot pin on their respective levers, the reproduction may be made larger or smaller than the original as desired.

219. This figure shows the "parallel ruler," a device used for drawing parallel lines. Two parallel rulers are connected by a pair of parallel links of equal length. The rulers will then always lie parallel to each other, whether swung apart or moved together.

220. A device for drawing a conchoid curve. A conchoid curve may be described as a curve of such form that when measured along lines drawn from a fixed point called the pole, it will, at all points, be equidistant from a straight line, called the asymptote. The device shown comprises a T-square with grooved head-piece adapted to receive a slide pivoted to a bar. A slot in the lower end of this bar engages a pin on the blade of the T-square and the opposite end of the bar carries the scribing pencil. The pin represents the pole and the grooved head of the T-square represents the asymptote. The curve traced by the pencil when measured along the bar lies everywhere equidistant from the asymptote.

221. An ellipsograph or a device for drawing ellipses. This is similar to the pantograph shown in Figure 218. The fixed pivot, however, is at *B*, the tracing point at *A*, and the pencil at *C*. When *A* is moved in a straight line toward or away from *B*, the pencil *C* will trace an elliptical curve.

222. A device for drawing a helical curve. A rod provided with a pivot point is threaded to receive a nut with a milled flange. As the rod is moved about its center, the nut is rotated by a frictional contact of the flange with the drawing paper, and is thus slowly fed toward or away from the center. A pencil carried by a sleeve on this nut will then trace a helical curve.

223. A device for describing parabolas. A pin is placed at the focus of the desired parabola and a straight-edge is placed on the line of the directrix. A slack cord is secured at one end to the pin, and at the other to the blade of a square whose stock bears against the straight edge. The slack of the cord is taken up by the pencil, which bears against the blade of the square. Sufficient slack is provided to make the distance of the pencil from the focus equal to its distance from the straight-edge or directrix. The curve then described by the pencil while keeping the cord taut against the square, as the square is moved along the straight-edge, will be a parabola.

224. A device for describing hyperbolas. The two pins shown represent the foci of two opposite hyperbolas. A ruler turns on one of these pins as a center, and its opposite end is connected with the other pin by a slack cord. The slack of the cord is taken up by the pencil which bears against the ruler. The curve described will then fulfil the conditions of a hyperbolic curve, which requires that the distance from any point in the curve to its focus, minus the distance from that point to any other fixed point or focus, should always be a constant quantity.

GOVERNORS.

A governor of a steam engine is a device for automatically operating the throttle, or for shortening the stroke of the slide valve when the engine attains a dangerous speed.

225. Watt's Governor.—When a dangerous speed is acquired, the centrifugal force acting upon a pair of balls tends to lift a sleeve which, through a bell crank, operates the throttle.

226. Porter's Governor.—The operation is very similar to that of Watt, but the balls are required to lift a weight which may be adjusted as desired.

227. Kley's Cross Arm Governor.—The degree of sensitiveness is governed by the length of the cross arms, and also by an adjustable weight, which is lifted by the balls.

228. Buss' Governor.—Two pairs of balls are used, one pair acting to counterbalance the other.

229. Tangye's Governor.—The balls when thrown out by centrifugal action depress a rod in the hollow central shaft and this rod acts directly on the block in the link thus shortening the stroke of the slide valve.

230 and 231. PROELL'S GOVERNOR.—In 230 the balls, aside from lifting a weight, act to compress a spiral spring. In 231 the outward movement of the balls is controlled by an air dashpot.

232. COSINE GOVERNOR.—A cross arm governor which acts to raise a weight.

233. PARABOLIC GOVERNOR.—The balls move on parabolic guide arms, which modify the effect of the centrifugal force, and produce equal valve movement, which is exactly proportional to the speed of the engine.

234. OSCILLATING LEVER GOVERNOR.—The balls are secured to the ends of a lever, which assumes a more horizontal position as the speed of the engine increases. A spring normally holds the arm in the tilted position illustrated.

235. SWEET'S FLYWHEEL GOVERNOR.—The centrifugal action of the ball moves the eccentric toward the center, thus reducing the stroke of the slide valve. A leaf spring resists the centrifugal action of the ball.

236. HARTNELL'S EXPANSION GOVERNOR.—The balls are thrown out by centrifugal force against the action of a spring raising the block in the link and thus varying the stroke of the valve.

237. HARTNELL'S CRANK SHAFT GOVERNOR.—The weights operate against the spring to move a toothed sector, which moves the eccentric toward the center of the crank shaft, thus varying the stroke of the slide valve.

238. TURNER'S CRANK SHAFT GOVERNOR.—The weights have bearings in the side plates of the governor. They also carry pins by which they are connected to the eccentric. When the weights are thrown out by centrifugal action, they move the eccentric toward the center of the crank shaft.

239 and 240. VANE GOVERNORS.—The shaft is prevented from rotating too rapidly by the atmospheric resistance acting on a pair of vanes. This resistance may be varied by adjusting the vanes to different angles. In some types of vane governors the inclined vanes serve to lift a sleeve, cutting off the supply of power.

SPRINGS.

241 and 242. LAMINATED OR CARRIAGE SPRINGS, used on carriages to take up the jolts of the wheels in passing over uneven roads. 241 shows the elliptical form, and 242 the semi-elliptical form. They are built up of flat spring metal strips.

243. WATCH OR CLOCK SPRING, used to drive a watch or clock train. The spring is formed of a flat spring metal strip, wound into a flat coil.

244. RIBBON SPRING.—A strip of flat spring metal mounted to exert a torsional pressure.

245. SPIRAL SPRING.—A length of round spring wire wound into spiral form. This spring could be used either as a tension or as a compression spring, though usually it has the form shown in Figure 247 when used as a tension spring. A spiral spring should never be extended or compressed more than one-third of its length.

246. SEAR SPRING.—This spring gets its name from its use in gun locks for causing the sear to catch in the notch of the tumbler. However, the spring is here shown as holding apart the arms of a compass.

247. TENSION SPIRAL SPRING.—A spiral spring which tapers toward the ends so that the pull will come centrally on the spring, thus giving an even tension and avoiding side strains.

248. FLAT OR LEAF SPRING.—A strip of flat spring metal used chiefly as a compression spring. A spring of this type is apt to lose its resiliency after continued use.

249. DISK SPRING.—A compression spring made up of a series of dished disks or plates.

250. HELICAL SPRING.—This spring differs from the spiral spring, Figure 245, in that it is formed by being wrapped around a cone, whereas a spiral spring is formed by being wrapped around a cylinder. The helical spring may safely be compressed until it lies flat like a clock spring.

251. VOLUTE SPRING.—A compression spring formed by coiling a flat spring ribbon into a helix.

252. FURNITURE SPRING.—A compression spring comprising a double helical spring used in furniture to support the cushioned backs or seats of chairs. This spring is also used in bed springs.

TRANSMISSION OF POWER BY BELTING.

THE TENACITY OF GOOD NEW BELT LEATHER varies from 3,000 lb. to 5,000 lb. per square inch of sectional area.

THE COEFFICIENT OF FRICTION between ordinary belting and cast-iron pulleys is about .423.

THE THICKNESS OF BELTS varies from three-sixteenths to five-sixteenths of an inch, or an average of one-fourth of an inch.

TENACITY OF RIVETING AND LACING.—The ultimate tenacity of good single leather belting may be taken at about 1,000 lb. per inch in width; the corresponding strength of a riveted joint being about 400 lb., a butt laced joint about 250 lb., and an ordinary overlap laced joint 470 lb. It is not customary, however, to allow an effective strain of more than one-fourth these amounts.

WORKING STRESS OF BELTS.—The following are the effective working stresses allowed for the different kinds and thicknesses of belts referred to in the table of powers.

Ordinary single belts,		50 lb.
Light double belts,		70 lb.
Heavy double belts,		90 lb.
Link belts,	$\frac{3}{8}$ in. thick,	42 lb.
"	" $\frac{1}{2}$ in. "	48 lb.
"	" $\frac{5}{8}$ in. "	57 lb.
"	" $\frac{3}{4}$ in. "	66 lb.
"	" $\frac{7}{8}$ in. "	78 lb.
"	" 1 in. "	90 lb.

SPEED OF BELTING.—On ordinary shop line shafts the velocity of the belts varies from 1,000 ft. to 1,500 ft. per minute. Lathe belts vary from 1,500 ft. to 3,000 ft. per minute.

STRESS ON SHAFTING.—The cross stress on shafting arising from the sum of the tension on the two sides of the belt may be taker at 90 lb. per inch in width.—Practical Electrical Engineers' Pocket Book and Diary.

HEIGHT OF COLUMNS, SPIRES AND TOWERS

Name	Location	Feet
Eiffel Tower	Paris, France,	984
Washington Monument	Washington, D. C.,	555
Cathedral	Ulm, Germany,	529
Cologne Cathedral	Cologne, Germany,	512
Pyramid of Cheops	Egypt,	482
St. Stephen's Cathedral	Vienna, Austria,	470
Strassburg Cathedral	Strassburg, Germany,	468
St. Peter's	Rome, Italy,	448
Cathedral	Salisbury, England,	406
Cathedral	Antwerp, Belgium,	402
Torrazzo Tower	Cremona, Italy,	396
Cathedral	Florence, Italy,	387
St. Paul's Cathedral	London, England,	364
Cathedral	Milan, Italy,	355
Hotel des Invalides	Paris, France,	344
St. Patrick's Cathedral	New York, U. S. A.,	332
St. Mark's (Campanile)	Venice, Italy,	323
Trinity Church	New York, U. S. A.,	284
Westminster Abbey	London, England,	283
Notre Dame	Paris, France,	223
Bunker Hill Monument	Boston, Mass,	221
Leaning Tower of Pisa	Pisa, Italy,	179

TABLE OF HIGH BUILDINGS WHICH EXCEED 300′ ABOVE SIDEWALK LEVEL.

Building.	Height In Feet
Woolworth Building	750
Metropolitan Tower	700
Singer Tower	612
Municipal Building	560
Bankers' Trust Building	539
Whitehall Building	446
Heidelberg Building	410
Liberty Tower	385
Park Row Building	382
Broadway-Cortlandt Building	360
Manhattan Life Building	348
Wall Street Exchange Building	345
221 West 41st St. & 218-26 W. 42d St.*	341
Walker-Lispenard Building*	338
110-112 West 40th Street*	335
Times Building	331
43-49 Exchange Place	327
37 Wall Street	318
80 Maiden Lane*	315
World Building	309
St. Paul Building	308
Rector St., Trinity Pl. & Greenwich St.	308
Hotel McAlpin*	307
West St., Cedar to Albany Sts.	306
60 Broadway	306
43rd-44th Sts., Madison & Vanderbilt Aves.*	305

* Buildings are in course of construction.
Revised by Bureau of Buildings, Borough of Manhattan, N. Y. C.

NAMES OF THE MONTHS IN FIVE LANGUAGES.

English.	Spanish.	Portuguese.	French.	German.
January.	enero.	janeiro.	janvier.	Januar.
February.	febrero.	fevereiro.	février.	Februar.
March.	marzo.	março.	mars.	März.
April.	abril.	abril.	avril.	April.
May.	mayo.	malo.	mai.	Mai.
June.	junio.	junho.	juin.	Juni.
July.	julio.	julho.	juillet.	Juli.
August.	agosto.	agosto.	août.	August.
September.	septiembre.	setembro.	septembre.	September.
October.	octubre.	outubro.	octobre.	Oktober.
November.	noviembre.	novembro.	novembre.	November.
December.	diciembre.	dezembro.	décembre.	Dezember.

NUMBER OF WORDS IN A LINE AND PAGE AND THE NUMBER OF EMS IN A PAGE

Sizes of type and measures.	Number of words in a line.	Number of words in a page.		Number of lines in a page.		Number of ems in a page.
		Solid.	Leaded.	Solid.	Leaded.	
10-point:						
General order	10	386	294	38	32	1,050
Document	12	693	528	54	45	1,856
Quarto	16	1,113	848	63	53	2,992
Census	18	1,386	1,056	68	57	3,621
8-point:						
General order	12	588	423	48	38	1,543
Document	15	1,056	759	67	54	2,920
Quarto	20	1,696	1,219	79	64	4,675
Census	25	2,112	1,518	84	68	5,696
6-point:						
General order	13	864	625	63	48	2,911
Document	17	1,551	1,122	90	67	5,141
Quarto	24	2,491	1,802	106	80	8,249
Census	27	3,102	2,244	112	84	10,115
14-point:						
Bill	10	.....	257	.....	25	.....

The above table is based on the Government "Printing Style Book."

CHAPTER V.

GEOMETRICAL CONSTRUCTIONS.

GEOMETRICAL FIGURES.

1. ACUTE ANGLE.—An acute angle is less than a right angle, or less than 90 degrees.

2. ALTERNATE ANGLES.—The internal angles made by two lines with a third, on opposite sides of it. If the two lines are parallel, the alternate angles are equal. If the parallels *AB*, *CD*, be cut by the line *EF*, the angles *AGH*, *GHD*, as also the angles *BGH* and *GHC*, are called alternate angles.

3. ARC.—Any part of the circumference of a circle or other curve; a segment of a circle.

4, 5, 6, and 7. CONIC SECTIONS.—Formed by the intersections of cones and planes. The conic sections are the ellipse, parabola, and hyperbola. If the section be taken parallel to the base of the cone its outline will form a perfect circle. If the section be taken parallel to one side of the cone it will in outline have the form of a parabola (6). If the section be taken parallel to the axis of the cone its outline will have the form of a hyperbola (7). Any other section through the cone will in outline have the form of an ellipse (5).

8. CHORD.—A right line marking the extremities of the arc of a circle.

9. CIRCLE.—1. In geometry, a plane figure, comprehended by a single curve line, called its circumference, every part of which is equally distant from a point called the center. Of course all lines drawn from the center to the circumference, or periphery, are equal to each other. 2. In popular use, the line that comprehends the figure, the plane or surface comprehended, and the whole body or solid matter of a round substance, are denominated a circle; a ring; an orb; the earth.

10. CURVE.—A curve line is one which may be cut by a right line in more points than one. A curve line is that which is neither a straight line nor composed of straight lines.

11. CUBE.—A regular, solid body with six equal square sides.

12. CYLINDER.—A solid body supposed to be generated by the rotation of a parallelogram round one of its sides; or a long, circular body, of uniform diameter, and its extremities forming equal parallel circles.

13. DIAGONAL.—The line extending from one angle to another of a quadrilateral or multilateral figure, and dividing it into two parts.

14. DIAGRAM.—A figure, draught, or scheme delineated for the purpose of demonstrating the properties of any figure, as a square, triangle, circle, etc.

15. DIAMETER.—A right line passing through the center of a circle, or other curvilinear figure, terminated by the curve, and dividing the figure symmetrically into two equal parts.

16. ELLIPSE.—In conic sections, a figure formed by the intersection of a plane and cone when the plane passes obliquely through the opposite sides of the cone.

17. EQUILATERAL TRIANGLE.—A triangle having all three sides equal.

18. HEXAGON.—A plane figure of six sides and six angles. If the sides and angles are equal, it is a regular hexagon. The cells of honey-comb are hexagons, and it is remarkable that bees instinctively form their cells of this figure, which fills any given space without any interstice or loss of room.

19. HYPOTHENUSE.—The subtense or longest side of a right-angled triangle, or the line that subtends the right angle.

20. RECTANGULAR TRIANGLE.—If one of the angles of a triangle is a right angle, the triangle is rectangular.

21. RIGHT ANGLE.—A right angle is one formed by a right line falling on another perpendicularly, or an angle of 90 degrees, making the quarter of a circle.

22. ISOSCELES TRIANGLE.—If two of the sides only are equal in a triangle it is an isosceles or equicrural triangle.

23. OBLIQUE LINE.—An oblique line is one that, falling on another, makes oblique angles with it.

24. OBTUSE ANGLE.—An angle greater than a right angle, or containing more than 90 degrees.

25. SCALENE TRIANGLE.—One in which all the three sides are unequal.

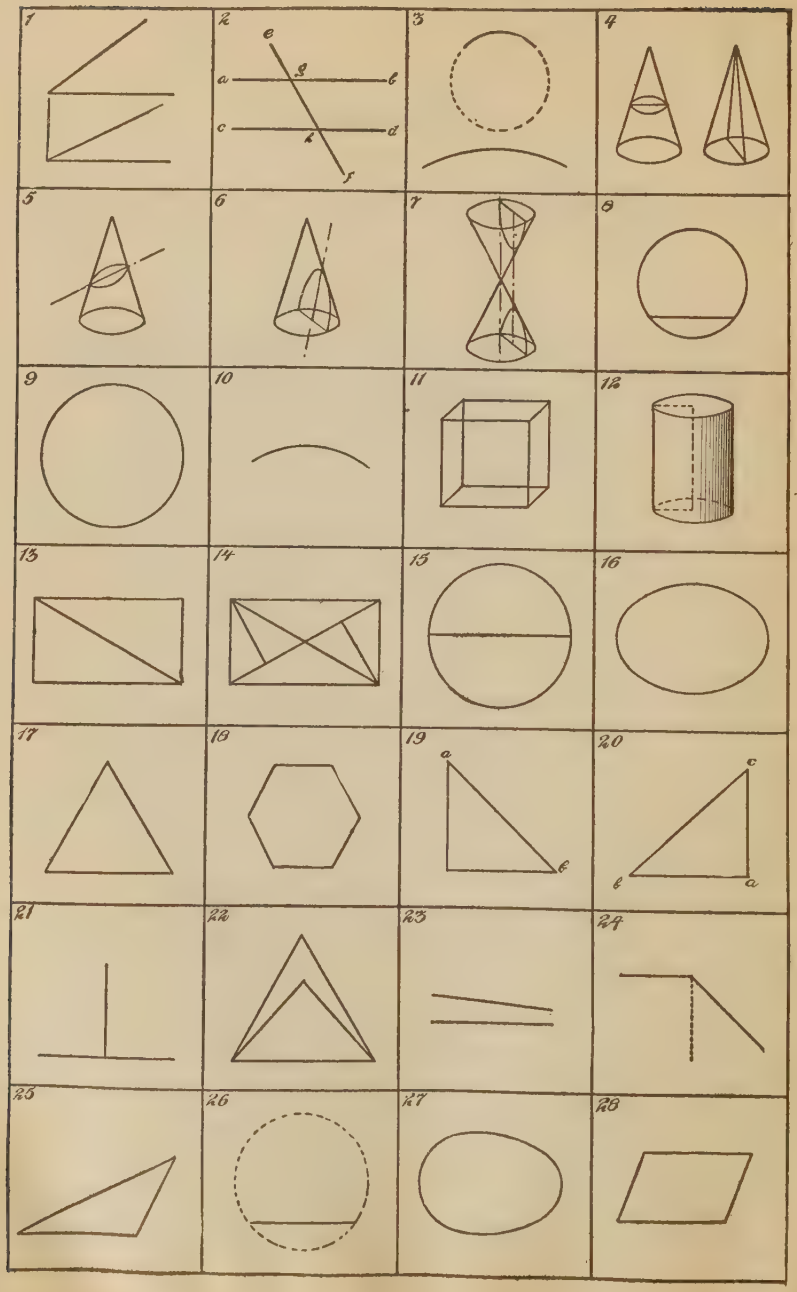
26. SECANT.—The secant of a circle is a line drawn from the circumference on one side to a point without the circumference on the other.

27. OVAL.—A body or figure in the shape of an egg, or of an ellipse.

28. PARALLELOGRAM.—1. In geometry, a right-lined quadrilateral figure, whose opposite sides are parallel, and consequently equal. 2. In common use, this word is applied to quadrilateral figures of more length than breadth.

29. SECTOR.—A part of a circle comprehended between two radii and the included arc; or a mixed triangle, formed by two radii and the arc of a circle.

30. PARALLELOPIPED.—A regular solid comprehended under six parallelograms, the opposite ones of which are similar, parallel, and equal to each other; or it is a prism whose base is a parallelogram. It is always triple to a pyramid of the same base and height. Or a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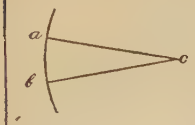

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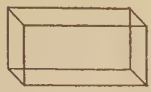

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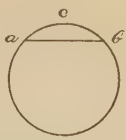

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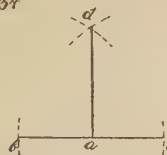

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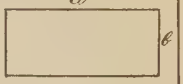

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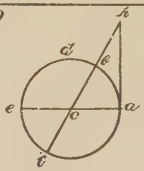

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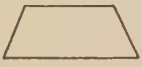

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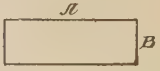

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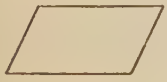

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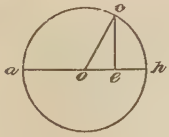

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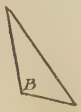

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parallelopiped is a solid figure bounded by six faces, parallel to each other, two and two.

31. PARALLEL LINES.—One line is parallel to another, when the lines are at an equal distance apart throughout the whole length.

32. SEGMENT OF A CIRCLE.—That part of the circle contained between a chord and an arc of that circle, or so much of the circle as is cut off by the chord. The segment of a sphere is a part cut off by a plane.

33. PENTAGON.—A plane figure having five angles, and consequently five sides.

34. PERPENDICULAR.—In geometry, a line falling at right angles on another line, or making equal angles with it on each side. Thus if the straight line *AD*, falling on the straight line *BC*, make the angles *BAD*, *DAC* equal to one another, *AD* is called a perpendicular to *BC*.

35. QUADRANGLE.—A plane figure having four angles, and consequently four sides.

36. RECTANGLE.—A four-sided figure having only right angles. A right-angled parallelogram.

37. QUADRANT.—The quarter of a circle or of the circumference of a circle.

38. QUADRILATERAL.—Having four sides, and consequently four angles.

39. TANGENT.—In the figure, let *AH* be a straight line drawn touching the circle *ADE* at *A*, one extremity of the arc *AB*, and meeting the diameter *IB* produced, which passes through the other extremity *B* to the point *H*; then *AH* is the tangent of the arc *AB*, or of the angle *ACB*, of which *AB* is the measure.

40. RADIUS.—A right line drawn or extending from the center of a circle to the periphery; the semidiameter of the circle. In trigonometry, the radius is equal to the sine of 90 degrees.

41. TRAPEZIUM.—A plane figure contained under four right lines, of which no two are parallel.

42. TRAPEZOID.—A plane, four-sided figure, having two of the opposite sides parallel to each other.

43. REFLECTION.—In the figure, let *AB* represent a smooth polished surface, or mirror, and suppose a ray of light proceeding in the direction *LP* to impinge on the surface at *P*, and to be reflected from it in the direction *PR*. From *P* draw *PQ* perpendicular to *AB*, then the angle *LPQ* is called the angle of incidence, and *QPR* the angle of reflection.

44. SUPERFICIES.—A superficies consists of length and breadth; as, the superficies of a plate or of a sphere. Superficies is rectilinear, curvilinear, plane, convex, or concave.

45. RHOMBOID.—A figure having some resemblance to a rhomb; or a quadrilateral figure whose opposite sides and angles are equal, but which is neither equilateral nor equiangular.

46. SEMICIRCLE.—The half of a circle; the part of a circle comprehended between its diameter and half of its circumference.

47. SQUARE.—A rectilinear figure having four equal sides and four right angles.

48. RECTILINEAR TRIANGLE.—One in which the three lines or sides are all right lines, as distinguished from curvilinear triangle.

49. RHOMB, RHOMBUS.—An oblique-angled, equilateral parallelogram, or a quadrilateral figure whose sides are equal and the opposite sides parallel, but the angles unequal, two of the angles being obtuse and two acute.

50. SINE.—In the circle *ACH*, let *AOH* be a diameter, and let *CE* be perpendicular thereto; then shall *CE* be the sine of the arc *CH*, or of the angle *COH*, and of its supplement *COA*. The sine of a quadrant, or of a right angle, is equal to the radius. The sine of any arc is half the chord of twice that arc.

51. ACUTE-ANGLED TRIANGLE.—One having all three of its angles acute.

52. AN EQUILATERAL TRIANGLE.—One having all the three sides equal.

53. POLYGON.—A plane figure of many angles, and consequently of many sides; particularly, one whose perimeter consists of more than four sides.

54. OBTUSANGULAR TRIANGLE.—If one of the angles of a triangle is obtuse, the triangle is called obtusangular or amblygonous.

55. CURVILINEAR AND SPHERICAL TRIANGLES.—If the three sides of a triangle are all curves, the triangle is said to be curvilinear. If the sides are all arcs of great circles of the sphere, the triangle is said to be spherical.

56. MIXTILINEAR TRIANGLE.—If some of the sides of a triangle are right and others curve, the triangle is said to be mixtilinear.

GEOMETRICAL CONSTRUCTIONS.*

1.

To divide a given line *A B* into two equal parts; and to erect a perpendicular through the middle.

With the end *A* and *B* as centers, draw the dotted circle arcs with a radius greater than half the line. Through the crossings of the arcs draw the perpendicular *C D*, which divides the line into two equal parts.

2.

From a given point *C* on the line *A B*, erect a perpendicular *C D*.

With *C* as a center, draw the dotted circle arcs at *A* and *B* equal distances from *C*. With *A* and *B* as centers, draw the dotted circle arcs at *D*. From the crossing *D* draw the required perpendicular *D C*.

3.

From a given point *C* at a distance from the line *A B*, draw a perpendicular to the line.

With *C* as a center, draw the dotted circle arc so that it cuts the line at *A* and *B*. With *A* and *B* as centers, draw the dotted cross arcs at *D* with equal radii. Draw the required perpendicular through *C* and crossing *D*.

4.

At the end of *A* to a given line *A B*, erect a perpendicular *A C*.

With the point *D* as a center at a distance from the line, and with *A D* as radius, draw the dotted circle arc so that it cuts the line at *E* through *E* and *D*, draw the diameter *E C*; then join *C* and *A*, which will be the required perpendicular.

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5.

Through a given point *C* at a distance from the line *A B*, draw a line *C D* parallel to *A B*.

With *C* as a center, draw the dotted arc *E D*, with *E* as a center, draw through *C* the dotted arc F. C. With the radius *F C* and *E* as a center, draw the cross arc at *D*. Join *C* with the cross at *D*, which will be the required parallel line.

6.

On a given line *A B* and at the point *B*, construct an angle equal to the angle *C D E*.

With *D* as a center, draw the dotted arc *C E*; and with the same radius and *B* as a ce. ter, draw the arc *G F*; then make *G F* equal to *C E*; then join *B F*, which will form the required angle, *F B G=C D E*.

7.

Divide the angle *A C B* into two equal parts.

With *C* as a center, draw the dotted arc *D E*; with *D* and *E* as centers, draw the cross arcs at *F* with equal radii. Join *C F*, which divides the angle into the required parts.

Angles *A C F=F C B=½(A C B)*.

8.

Divide an angle into two equal parts, when the lines do not extend to a meeting point.

Draw the lines *C D* and *C E* parallel, and at equal distances from the lines *A B* and *F G*. With *C* as a center, draw the dotted arc *B G*; and with *B* and *G* as centers, draw the cross arcs *H*. Join *C H*, which divides the angle into the required equal parts.

9.

To construct a parallelogram, with the given sides *A* and *B* and angle *C*.

Draw the base line *D E*, and make the angle *F D E=C*; lines *D E=B* and *D F=A*; complete the parallelogram by cross arcs at *G*, and the problem is thus solved.

10.

To divide the line *A B* in the same proportion of parts as *A C*.

Join *C* and *B*, and through the given divisions 1, 2, and 3 draw lines parallel with *C B*, which solves the problem.

11.

To find the center of a circle which will pass through three given points *A*, *B*, and *C*.

With *B* as a center, draw the arc *D E F G*; and with the same radius and *A* as a center, draw the cross arcs *D* and *F*; also with *C* as a center, draw the cross arcs *E* and *G*. Join *D* and *F*, and also *E* and *G*, and the crossing *o* is the required center of the circle.

12.

To construct a square upon a given line *A B*.

With *A B* as radius and *A* and *B* as centers, draw the circle arcs*A E D* and *B E C*. Divide the arc *B E* in two equal parts at *F*, and with *E F* as radius, and *E* as center, draw the circle *C F D*. Join *A* and *C B* and *D*, *C* and *D*, which completes the required square.

13.

Through a given point *A* in a circumference, draw a tangent to the circle.

Through a given point *A* and center *C*, draw the line *B C*. With *A* as a center, draw the circle arcs *B* and *C*; with *B* and *C* as centers, draw the cross arcs *D* and *E*; then join *D* and *E*, which is the required tangent.

14.

From a given point *A* outside of a circumference, draw a tangent to the circle.

Join *A* and *C*, and upon *A C* as a diameter draw the half circle *A B C*, which cuts the given circle at *B*. Join *A* and *B*, which is the required tangent.

15.

To draw a circle with a given radius *R*, that will tangent the circle *A B C* at *C*.

Through the given point *C*, draw the diameter *A C* extended beyond *D*; from *C* set off the given radius *R* to *D*; then *D* is the center of the required circle, which tangents the given circle at *C*.

16.

To draw a circle with a given radius *R*, that will tangent two given circles.

Join the centers *A* and *B* of the given circles Add the given radius *R* to each of the radii of the given circle, and draw the cross arcs *C*, which is the center of the circle required to tangent the other two.

17.

To draw a tangent to two circles of different diameters.

Join the centers *C* and *c* of the given circles, and extend the line to *D*; draw the radii *A C* and *a c* parallel with one another. Join *A a*, and extend the line to *D*. On *C D* as a diameter, draw the half circle *C e D*; on *c D* as a diameter, draw the half circle *c f D*; then the crossings *e* and *f* are the tangenting points of the circles.

18.

To draw a tangent between two circles.

Join the centers *C* and *c* of the given circles; draw the dotted circle arcs, and join the crossing *m*, *n*, which line cuts the center line at *a*. With *a C* as a diameter, draw the half circle *a f C*; and with *a c* as a diameter, draw the half circle *c e a*; then the crossings *e* and *f* are the tangenting points of the circles.

19.

With a given radius *r*, draw a circle that will tangent the given line *A B* and the given circle *C D*.

Add the given radius *r* to the radius *R* of the circle, and draw the arc *c d*. Draw the line *c e* parallel with and at a distance *r* from the line *A B*. Then the crossing *c* is the center of the required circle that will tangent the given line and circle.

20.

To find the center and radius of a circle that will tangent the given circle *A B* at *C*, and the line *D E*.

Through the given point *C*, draw the tangent *G F*; bisect the angle *F G E*; then *o* is the center of the required circle that will tangent *A B* at *C*, and the line *D E*.

21.

To find the center and radius of a circle that

will tangent the given line *A B* at *C*, and the circle *D E*.

Through the point *C*, draw the line *E F* at right angles to *A B;* set off from *C* the radius *r* of the given circle. Join *G* and *F*. With *G* and *F* as centers draw the arc crosses *m* and *n*. Join *m n*, and where it crosses the line *E F* is the center for the required circles.

22.

To find the center and radius of a circle that will tangent the given line *A B* at *C*, and the circle *D E*.

From *C*, erect the perpendicular *C G;* set off the given radius *r* from *C* to *H*. With *H* as a center and *r* as radius, draw the cross arcs on the circle. Through the cross arcs draw the line *I G;* then *G* is the center of the circle arc *F I C*, which tangents the line at *C* and the circle at *F*.

23.

Between two given lines, draw two circles that will tangent themselves and the lines.

Draw the center line *A B* between the given lines; assume *D* to be the tangenting point of the circles; draw *D C* at right angles to *A B*. With *C* as center and *C D* as radius, draw the circle *E D F*. From *E*, draw *E m* at right angles to *E F;* and from *F* draw *F m* at right angles to *F E;* then *m* and *n* are the centers for the required circles.

24.

Draw a circle that will tangent two given lines *A B* and *C D* inclined to one another and the one tangenting point *E* being given.

Draw the center line *G F*. From *E*, draw *E F* at right angles to *A B;* then *F* is the center of the circle required.

25.

Draw a circle that will tangent two lines and go through a given point *C* on the line *F C*, which bisects the angle of the lines.

Through *C* draw *A B* at right angles to *C F;* bisect the angles *D A B* and *E B A*, and the crossing on *C F* is the center of the required circle.

26.

To draw a *cyma*, or two circle arcs that will tangent themselves, and two parallel lines at given points *A* and *B*.

Join *A* and *B;* divide *A B* into four equal parts and erect perpendiculars. Draw *A m* at right angles from *A*, and *B n* at right angles from *B;* then *m* and *n* are the centers of the circle arcs of the required *cyma*.

27.

To draw a *talon*, or two circle arcs, that will tangent themselves, and meet two parallel lines at right angles in the given points *A* and *B*.

Join *A* and *B;* divide *A B* into four equal parts and erect perpendiculars; then *m* and *n* are the centers of the circle arcs of the required *talon*.

28.

To plot out a circle arc without recourse to its center, but its chord *A B* and height *h* being given.

With the chord as radius, and *A* and *B* as centers, draw the dotted circle arcs *A C* and *B D*. Through the point *O* draw the lines *A O o* and *B O o*. Make the arcs *C o = A o* and *D o = B o*. Divide these arcs into any desired number of equal parts, and number them as shown on the illustration. Join *A* and *B* with the divisions, and the crossings of equal numbers are points in the circle arc.

29.

To find the center and radius of a circle that will tangent the three sides of a triangle.

Bisect two of the angles in the triangle, and the crossing *C* is the center of the required circle.

30.

To inscribe an equilateral triangle in a circle.

With the radius of the circle and center *C* draw the arc *D F E;* with the same radius, and *D* and *E* as centers, set off the points *A* and *B*. Join *A* and *B*, *B* and *C*, *C* and *A*, which will be the required triangle.

31.

To inscribe a square in a given circle.

Draw the diameter *A B*, and through the center erect the perpendicular C D, and complete the square as shown in the illustration.

32.

To describe a square about a given circle.

Draw the diameters *A B* and *C D* at right angles to one another; with the radius of the circle, and *A*, *B*, *C*, and *D* as centers, draw the four dotted half circles which cross one another in the corners of the square, and thus complete the problem.

33.

To inscribe a *pentagon* in a given circle.

Draw the diameter *A B*, and from the center *C* erect the perpendicular *C D*. Bisect the radius *A C* at *E;* with *E* as center, and *D E* as radius, draw the arc *D E*, and the straight line *D F* is the length of the side of the pentagon.

34.

To construct a *pentagon* on a given line *A B*.

From B erect *B C* perpendicular to and half the length of *A B;* join *A* and *C* prolonged to *D;* with *C* as a center and *C B* as radius, draw the arc *B D;* then the chord *B B* is the radius of the circle circumscribing the pentagon. With *A* and *B* as centers, and *B D* as radius, draw the cross *O* in the center.

35.

To construct a pentagon on a given line *A B* without resort to its center.

From *B* erect *B o* perpendicular and equal to *A B;* with *C* as center and *C o* as radius, draw the arc *D o;* then *A D* is the diagonal of the pentagon. With *A D* as radius and *A* as center, draw the arc *D E;* and with *E* as center and *A B* as radius, finish the cross *E*, and thus complete the pentagon.

36.

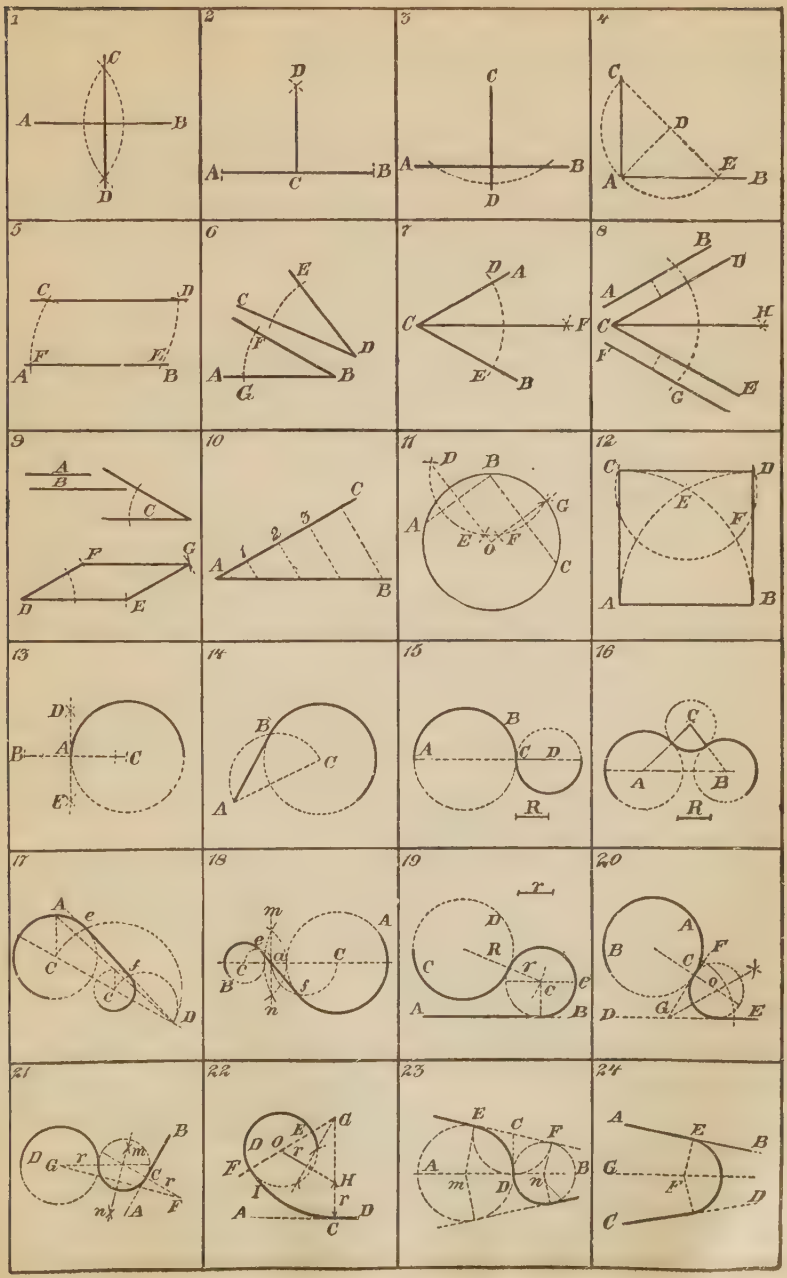
To construct a *hexagon* in a given circle.

The radius of the circle is equal to the side of the hexagon.

37.

To construct a Heptagon.

The appotem *a* in a hexagon is the length of the side of the heptagon.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Set off *A B* equal to the radius of the circle; draw *a* from the center *C* at right angles to *A B;* then *a* is the required side of the heptagon.

38.

To construct an *octagon* on the given line *A B*.

Prolong *A B* to *C*. With *B* as center and *A B* as radius, draw the circle *A F D E C;* from *B*, draw *B I* at right angles to *A B;* divide the angles *A B D* and *D B C* each into two equal parts; then *B E* is one side of the octagon. With *A* and *E* as centers, draw the arcs *H K E* and *A K I*, which determine the points *H* and *I*, and thus complete the octagon as shown in the illustration.

39.

To cut off the corners of a square, so as to make of it a regular *octagon*.

With the corners as centers, draw circle arcs through the center of the square to the side, which determines the cut-off.

40.

The area of a regular polygon is equal to the area of a triangle whose base is equal to the sum of all the sides, and the height *a* equal to the appotem of the polygon.

The reason of this is that the area of two or more triangles *A B C* and *A D C* having a common or equal base *b* and equal height *h* are alike.

41.

To construct any regular *polygon* on a given line *A B* without resort to its center.

Extend *A B* to *C* and, with *B* as center, draw the half circle *A D B*. Divide the half circle into as many parts as the number of sides in the polygon, and complete the construction as shown on the illustration.

42.

To construct an isometric ellipse by compasess and six circle arcs.

Divide *O A* and *O B* each into three equal parts; draw the quadrant *A C*. From *C*, draw the line *C c* through the point 1. Through the points 2 draw *d e* at an angle of 45° with the major axis. Then 2 is the center for the ends of the ellipse; *e* is the center for the arc *d c;* and *C* is the center for the arc *c f*.

43.

To construct a Hyperbola by plotting,

Having given the transverse axis *B C*, vertexes *A a*, and foci *f f'*. Set off any desired number of parts on the axis below the focus, and number them 1, 2, 3, 4, 5, etc. Take the distance *a* 1 as radius, and, with *f'* as center, strike the cross 1 with *f'* 1 = *a* 1. With the distance *A* 1, and the focus *f* as center, strike the cross 1 with the radius *F* 1 = *A* 1, and the cross 1 is a point in the hyperbola.

44.

To draw an Hyperbola by a pencil and a string,

Having given the transverse axis *B C*, foci *f* and *f*, and the vertexes *A* and *a*. Take a rule and fix it to a string at *e;* fix the other end of the string at the focus *f*. The length of the string should be such that when the rule *R* is in the position *f' C*, the loop of the string should reach to *A;* then move the rule on the focus *f'*, and a pencil at *P*, stretching string, will trace the hyperbola.

45.

To construct a Parabola by plotting,

Having given the axis, vertex, and focus of the parabola. Divide the transverse axis into any desired number of parts 1, 2, 3, etc., and draw ordinates through the divisions; take the distance *A* 1, and set it off on the 1st ordinate from the focus *f* to *a*, so that *A* 1 = *f a*. Repeat the same operation with the other ordinates—that is, set off the distance *A* 5 from *f* to *e*, so that *A* 5 = *f e;* and so the parabola is constructed.

46.

To draw a Parabola with a pencil and a string,

Having given the two axes, vertex, and focus of the parabola. Take a square *c d e*, and fix to it a string at *c;* fix the other end of the string at the focus *f*. The length of the string should be such that when the square is in the position of the axis *A f*, the string should reach to the vertex *A*. Move the square along *B B*, and the pencil *P* will describe the parabola.

47.

Schiele's anti-friction curve.

R represents the radius of the shaft, and *C* 1, 2, 3, etc., is the center line of the shaft. From *o*, set off the small distance *o a;* and set off *a* 1 = *R*. Set off the same small distance from *a* to *b*, and make *b* 2 = *R*. Continue in the same way with the other points, and the anti-friction curve is thus constructed.

48.

Isometric Perspective.

This kind of perspective admits of scale measurements the same as any ordinary drawing, and gives a clear representation of the object. It is easily learned. All horizontal rectangular lines are drawn at an angle of 30°.

All circles are ellipses of proportion, as shown in No. 42, on the following page.

49.

To construct an ellipse.

With *a* as a center, draw two concentric circles with diameters equal to the long and short axes of the desired ellipse. Draw from *o* any number of radii, *A*, *B*, etc. Draw a line *B b'* parallel to *n* and *b b'* parallel to *m*, then *b* is a point in the desired ellipse.

50.

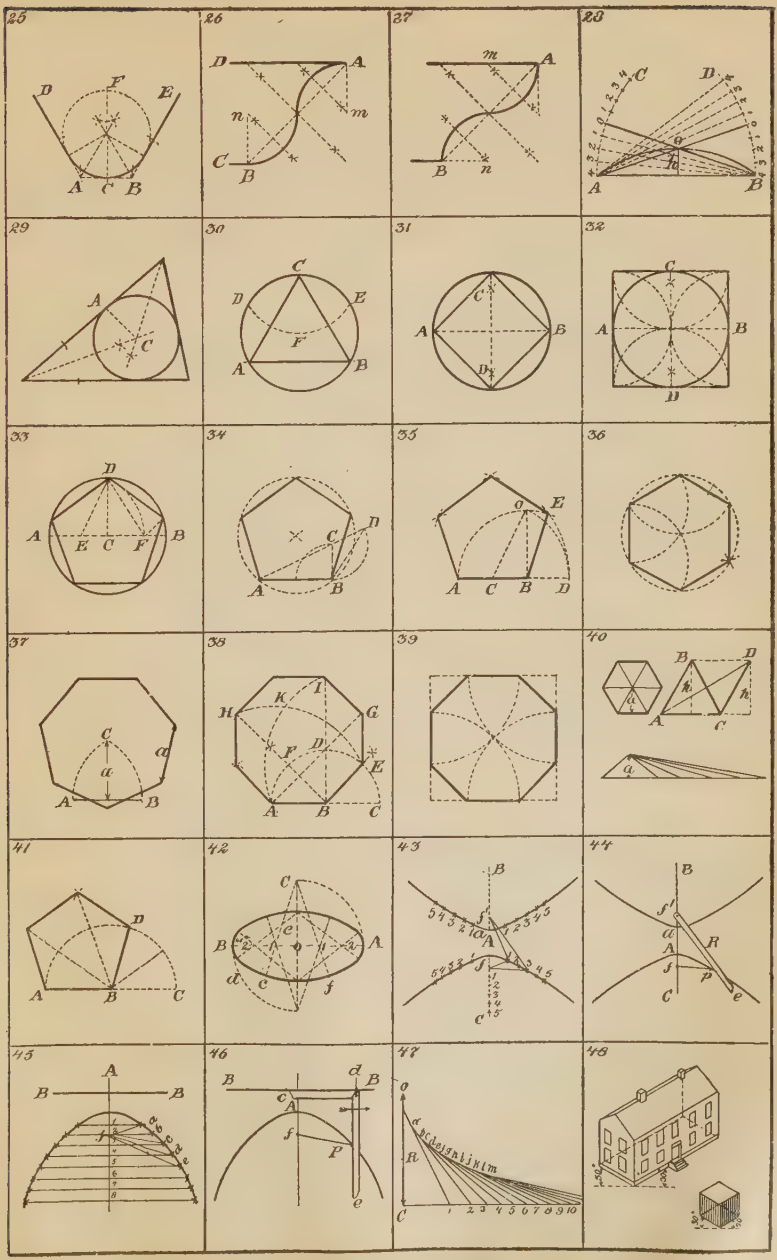
To draw an ellipse with a string.

Having given the two axes, set off from *c* half the great axis at *a* and *b*, which are the two focuses of the ellipse. Take an endless string as long as the three sides in the triangle *a b c*, fix two pins or nails in the focuses, one in *a* and one in *b*, lay the string around *a* and *b*, stretch it with a pencil *d*, which then will describe the desired ellipse.

51.

To draw an ellipse by circle arcs.

Divide the long axis into three equal parts, draw the two circles, and where they intersect one another are the centers for the tangent arcs of the ellipse as shown by the figure.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52.

To draw an ellipse by circle arcs.

Given the two axes, set off the short axis from A to b, divide b into three equal parts, set off two of these parts from o towards c and c which are the centers for the ends of the ellipse. Make equilateral triangles on $c\,c$, when $e\,e$ will be the centers for the sides of the ellipse. If the long axis is more than twice the short one, this construction will not make a good ellipse.

53.

To construct an ellipse.

Given the two axes, set off half the long axis from c to $f\,f$, which will be the two focuses in the ellipse. Divide the long axis into any number of parts, say a to be a division point. Take $A\,a$ as radius and f as center and describe a circle arc about b, take $a\,B$ as radius and f as center describe another circle arc about b, then the intersection b is a point in the ellipse, and so the whole ellipse can be constructed.

54.

To draw an ellipse that will tangent two parallel lines in A and B.

Draw a semicircle on $A\,B$, draw ordinates in the circle at right angle to $A\,B$, the corresponding and equal ordinates for the ellipse to be drawn parallel to the lines, and thus the elliptic curve is obtained as shown by the figure.

55.

To construct a cycloid.

The circumference $C = 3.14\,D$. Divide the rolling circle and base line C into a number of equal parts, draw through the division point the ordinates and abscissas, make $a\,a' = 1\,d$, $b\,b' = 2'e$, $c\,c = 3\,f$, then $a\,b'$ and c' are points in the cycloid. In the *Epicycloid* and *Hypocycloid* the abscissas are circles and the ordinates are radii to one common center.

56.

Evolute of a circle.

Given the pitch p, the angle v, and radius r. Divide the angle v into a number of equal parts, draw the radii and tangents for each part, divide the pitch p into an equal number of equal parts, then the first tangent will be one part, second two parts, third three parts, etc., and so the *Evolute* is traced.

57.

To construct a spiral with compasses and four centers.

Given the pitch of the spiral, construct a square about the center, with the four sides together equal to the pitch. Prolong the sides in one direction as shown by the figure, the corners are the centers for each arc of the external angles.

58.

To construct a Parabola.

Given the vertex A, axis x, and a point P. Draw $A\,B$ at right angle to x, and $B\,P$ parallel to x, divide $A\,B$ and $B\,P$ into an equal number of equal parts. From the vertex A draw lines to the divisions on $B\,P$, from the divisions on $A\,B$ draw the ordinates parallel to x, the corresponding intersections are points in the *parabola*.

59.

To construct a Parabola.

Given the axis of ordinate B, and vertex A. Take A as a center and describe a semicircle from B which gives the focus of the *parabola* at f. Draw any ordinate y at right angle to the abscissa $A\,x$, take a as radius and the focus f as a center, then intersect the ordinate y, by a circle-arc in P which will be a point in the *parabola*. In the same manner the whole Parabola is constructed.

60.

To draw an arithmetic spiral.

Given the pitch p and angle v, divide them into an equal number of equal parts, say 6; make $0\,1 = 0\,1$, $0\,2 = 0\,2$, $0\,3 = 0\,3$, $0\,4 = 0\,4$, $0\,5 = 0\,5$, and $0\,6 =$ the pitch p; then join the points 1, 2, 3, 4, 5 and 6, which will form the spiral required.

THE CIRCLE.

Notation of Letters.

d = diameter of the circle.
r = radius of the circle.
p = periphery or circumference.
a = area of a circle or part thereof.
b = length of a circle arc.
c = chord of a segment, length of.
h = height of a segment.
s = side of a rectangular polygon
v = center angle.
w = polygon angle.

All measures must be expressed by the same unit.

FORMULAS FOR THE CIRCLE.

Periphery or Circumference.

$p = \pi\,d = 3.14d.$

$p = 2\pi\,r = 6.28r.$

$p = 2\sqrt{\pi\,a} = 3.54\sqrt{a}.$

$$p = \frac{2a}{r} = \frac{4a}{d}.$$

Diameter and Radius.

$$d = \frac{p}{\pi} = \frac{p}{3.14}.$$

$$r = \frac{p}{2\pi} = \frac{p}{6.28}.$$

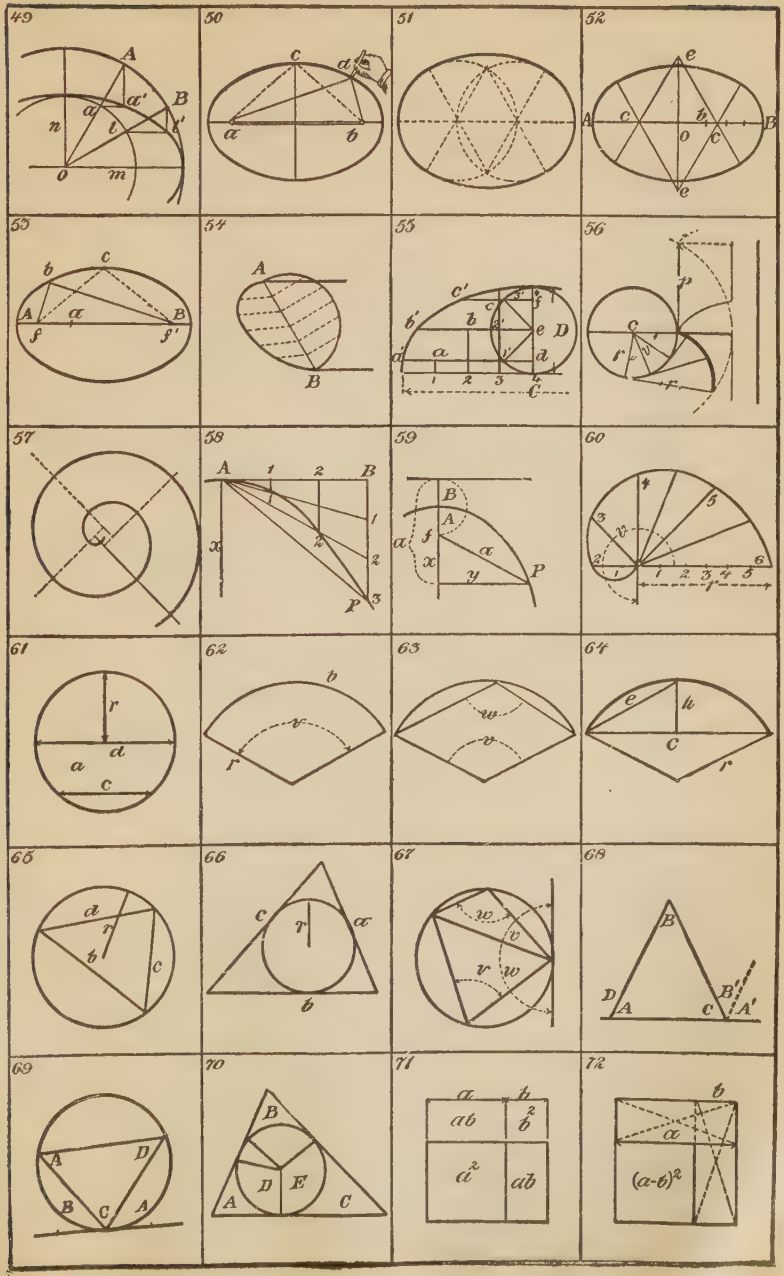
$$d = 2\sqrt{\frac{a}{\pi}} = 1.128\sqrt{a}$$

$$r = \sqrt{\frac{a}{\pi}} = 0.564\sqrt{a}.$$

Area of the Circle.

$$a = \frac{\pi\,d^2}{4} = 0.785d^2$$

$$a = \pi\,r^2 = 3.14r^2.$$


49
A
B
a
a'
b'
n
t
o
m
50
c
d
a
b
51
52
e
A
c
t
o
C
B
e
53
b
c
A
a
B
f
f'
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p
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60
4
5
3
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1
6
1 2 3 4 5
61
r
a
d
c
62
b
r
63
w
v
64
e
h
C
r
65
d
r
b
c
66
c
r
a
b
67
w
v
r
w
68
B
D
A
c
B'
A'
69
A
D
B
C
A
70
B
D
E
A
C
71
a
b
ab
b²
a²
ab
72
b
a
(a-b)²

$$a=\frac{p^2}{4\pi}=\frac{p^2}{12.56}.$$

$$a=\frac{pr}{2}=\frac{pd}{4}.$$

$\pi=3.14159265358979323846264338327950288$
$\quad 4197169399$
$2\pi=6.283185$
$3\pi=9.424778$
$4\pi=12.566370$
$5\pi=15.707963$
$6\pi=18.849556$
$7\pi=21.991148$
$8\pi=25.132741$
$9\pi=28.274334$
$\frac{1}{4}\pi=0.785398$
$\frac{1}{3}\pi=1.047197$
$\frac{1}{2}\pi=1.570796$
$\frac{2}{4}\pi=0.392699$
$\frac{1}{6}\pi=0.523599$
$\frac{1}{12}\pi=0.261799$
$\frac{2}{3}\pi=2.094394$
$\frac{1}{360}\pi=0.008726$
$\frac{1}{\pi}=0.318310$
$\frac{2}{\pi}=0.636619$
$\frac{3}{\pi}=0.954929$
$\frac{4}{\pi}=1.273239$
$\frac{6}{\pi}=1.909859$
$\frac{8}{\pi}=2.546478$
$\frac{12}{\pi}=3.819718$
$\frac{360}{\pi}=114.5915$
$\pi^2=9.869650$
$\sqrt{\pi}=1.772453$
$\sqrt{\frac{1}{\pi}}=0.564189$
$\sqrt{\frac{\pi}{2}}=1.253314$
$\sqrt{\frac{2}{\pi}}=0.797884$
$\text{Log. } \pi=0.49714987$

61.

The periphery of a Circle is commonly expressed by the *Greek* letter $\pi=3.14$ when the diameter $d=1$ or the unit. For any other value of the diameter d, we will denote the periphery by the letter p, $r=$radius, and $a=$ area of the circle. The periphery of a circle is equal to 3 14-100 times its diameter, $c=$chord,

62.

$$b=\frac{\pi r v}{180}=0.0175rv,$$

$$v=\frac{180b}{\pi r}=57.296\frac{b}{r}.$$

63.

$$w=180-\frac{v}{2},$$

$$v=2(180^\circ-w).$$

64.

$$r=\frac{c^2+4h^2}{8h}=\frac{e^2}{2h},$$

$$c=2\sqrt{2hr-h^2}.$$

65.

$$r=\frac{ac}{2\sqrt{a^2-\left(\frac{a^2+b^2-c^2}{2b}\right)^2}}.$$

66.

$$r=\frac{b\sqrt{a^2-\left(\frac{a^2+b^2-c^2}{2b}\right)^2}}{a+b+c}.$$

67.

$$v=v,\quad w=w,$$

$$w+v=180^\circ,\ w>v.$$

68.

$$D=B+C,\quad A'+B'+C=180^\circ,$$
$$B=D-C,\quad A+B+C=180^\circ,$$
$$A'=A,\quad B'=B.$$

69.

$$A+B+C=180^\circ,$$

$$A'=A,\quad B'=B.$$

70.

$$E+C=A+D=180^\circ,$$

$$D=B+c,$$

$$E=A+B.$$

71.

$$(a+b)^2=a^2+2ab+b^2.$$

72.

$$(a-b)^2=a^2-2ab+b^2.$$

73.

$$(a+b)\ (a-b)=a^2-b^2.$$

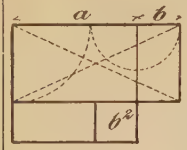
74.

$$a:b=c:d,$$

$$ad=bc,$$

$$A=B.$$

73



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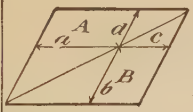

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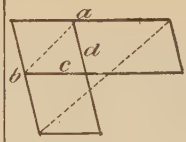

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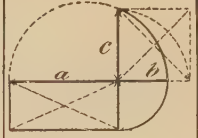

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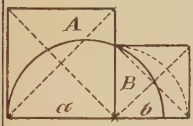

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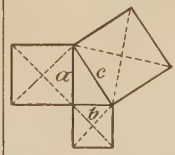

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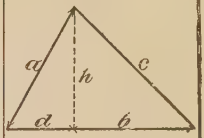

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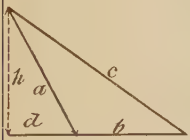

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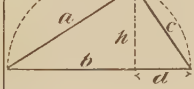

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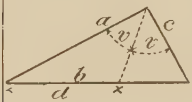

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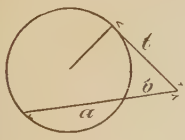

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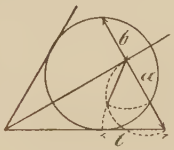

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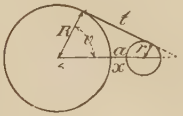

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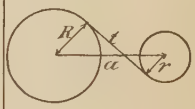

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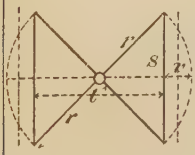

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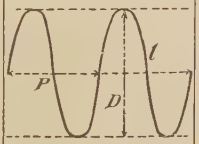

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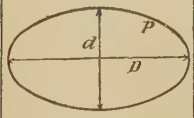

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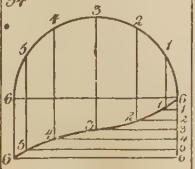

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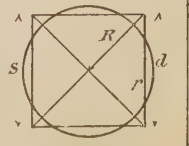

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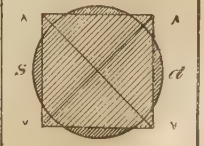


75.

$a : b = c : d,$

$ad = bc.$

76.

$a : c = c : b,$

$ab = c^2,$

$c = \sqrt{ab}.$

77.

$A : B = a : b.$

78.

$a : x = x : a - x,$

$$x = \sqrt{a^2 + \left(\frac{a}{2}\right)^2} - \frac{a}{2}$$

79.

$c^2 = a^2 + b^2,$

$a^2 = c^2 - b^2,$

$b^2 = c^2 - a^2.$

80.

$c^2 = a^2 + b^2 - 2bd,$

$h = \sqrt{a^2 - d^2}.$

$$d = \frac{a^2 + b^2 - c^2}{2b}.$$

81.

$c^2 = a^2 + b^2 + 2bd,$

$h^2 = \sqrt{a^2 - d^2},$

$$d = \frac{c^2 - a^2 - b^2}{2b}.$$

82.

$a : b = h : c,$

$$h = \frac{ac}{b} = \frac{ad}{c},$$

$$d = \frac{c^2}{b} = \frac{ch}{a}.$$

83.

$a : c = d : (b - d),$

$$d = \frac{ab}{c + a},$$

$v = v.$

84.

$a : c = b : d,$

$ad = bc.$

85.

$a : t = t : b,$

$t^2 = ab.$

86.

$t^2 = (a + b)\ (a - b),$

$t = \sqrt{a^2 - b^2}.$

87.

$$x = \frac{aR}{R - r}, \quad a = \sqrt{t^2 + (R - r)^2},$$

$$t = \sqrt{a^2 - (R - r)^2}, \quad \sin. v = \frac{t}{a}.$$

88.

$t = \sqrt{a^2 - (R + r)^2},$

$a = \sqrt{t^2 + (R + r)^2}.$

89.

$$V = r - \sqrt{r^2 - \frac{S^2}{4}} \qquad l = 2r - V,$$

$$S = 2\sqrt{r^2 - (r - V)^2}. \quad r = \tfrac{1}{2}(l + V).$$

90.

$$P = \sqrt{\frac{l^2}{n^2} - \pi^2 d^2},$$

$$l = n\sqrt{\pi^2 d^2 + P^2},$$

$$n = \frac{l}{\sqrt{\pi^2 d^2 + P}}.$$

91.

To find the length of a Spiral.

$$l = \pi r n = \frac{\pi r^2}{P}, \quad n = \frac{l}{\pi r} = \frac{r}{P},$$

$$P = \frac{\pi r^2}{l} = \frac{r}{n}. \quad P = Pitch.$$

92.

To find the length of a Spiral.

$l = \pi\, n\, (R + r),$

$$l = \frac{\pi}{P}(R^2 - r^2).$$

93.

Periphery of an Ellipse.

$p = 2\sqrt{D2 + 1.4674 d^2}.$

94.

To construct a screw *Helix.*

95.

To square a Circumference.

$R = 0.555355\ d = 1.1107\ r = 0.7071\ S.$

$S = 0.785398\ d = 1.57079\ r = 1.4142\ R$

$d = 1.27322\ S = 1.79740\ R = 2r.$

96.

To square a Circleplane.

$R = 0.626657\ d = 1.253314\ r = 0.7071\ S$

$S = 0.886226\ d = 1.77245\ r = 1.4142\ R$

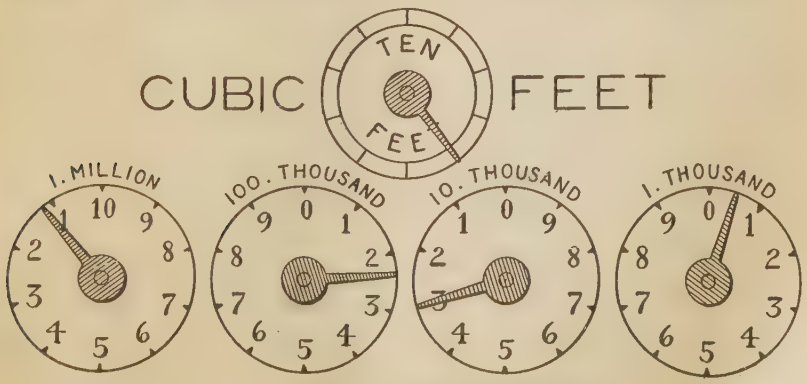
$d = 1.12838\ S = 1.5367\ R = 2\,r.$

CHAPTER VI.

WEIGHTS AND MEASURES.

HOW TO READ A GAS METER.

The dial marked "1 THOUSAND" in the accompanying illustration is divided into hundreds; the dial marked "10 THOUSAND" is divided into thousands; that marked "100 THOUSAND" into ten-thousands, and that marked "1 MILLION" into hundred-thousands. When 1,000 cubic feet of gas have been consumed, the pointer on the dial marked "1 THOUSAND" will have made a complete rotation and the fact will be indicated by the pointer of the next dial at the left, which will point to the figure 1. When 10,000 cubic feet of gas have been consumed, the pointer on the "10 THOUSAND" dial will point to 1, and so on. In reading a gas meter, put down the hundreds first, then the thousands, and so on, always counting the figure just under, or which has just been passed by, the pointer. In the illustration about half a hundred is indicated on the "1 THOUSAND" dial, three thousands is indicated on the next dial, two ten-thousands on the next dial, and one one-hundred-thousands on the "1 MILLION" dial. The reading will be 123,050. The dial marked "TEN FEET" is called the units dial. It is used for testing the meter to discover whether it is in working order or not. Each mark represents a cubic foot and the complete circle 10 cubic feet. If the pointer moves when no gas is burning, it indicates a leak. If it does not move when the gas is burning, or if its motion is unsteady, it indicates a derangement in the mechanism and shows that the meter requires attention.



GAS METER INDICATOR DIALS.

WEIGHTS AND MEASURES.

LINEAR MEASURE.

3 barleycorns, or...	
13 lines, or.....	1 inch (in.)
72 points, or.....	
1,000 mils (mi.).....	
3 inches.....1 palm	
4 inches.....1 hand	
9 inches.....1 span	
12 inches.....1 foot (ft.)	
18 inches.....1 cubit	
3 feet.....1 yard (yd.)	
2½ feet.....1 military pace	
5 feet.....1 geometrical pace	
2 yards.....1 fathom	
5½ yards.....1 rod, pole, or perch	
66 feet, or.....	1 Gunter's chain
4 rods.....	
40 poles, or.....	1 furlong (fur.)
220 yards.....	
8 furlongs, or.....	
1,760 yards, or.....	1 mile
5,280 feet.....	
3 miles.....1 league	

The hand is used to measure horses' height. The military pace is the length of the ordinary step of a man. One thousand geometrical paces were reckoned to a mile.

LAND MEASURE (LINEAR).

7.92 inches.....1 link	
100 links, or.....	
66 feet, or.....	1 chain (ch.)
22 yards, or.....	
4 poles.....	
10 chains.....1 furlong (fur.)	
80 chains, or.....	1 mile
8 furlongs.....	

LAND MEASURE (SQUARE).

144 sq. inches....1 square foot (sq. ft.)	
9 square feet..1 square yard (sq. yd.)	
30¼ sq. yards....1 sq. pole, rod, or perch	
16 sq. poles....1 square chain (sq. ch.)	
40 sq. poles, or	1 sq. rood
1,210 sq. yards...	
4 roods, or....	
10 sq. chs., or...	
160 sq. poles, or.	1 acre*
4,840 sq. yds., or...	
43,560 sq. ft.....	
640 acres, or....	1 sq. mile
3,097,600 sq. yds.....	
30 acres.....1 yard of land	
100 acres.....1 hide of land	
40 hides.....1 barony	

* The side of a square having an area of an acre is equal to 69.57 linear yards.

CUBIC MEASURE.

1,728 cubic inches.....1 cubic foot
27 cubic feet.....1 cubic or solid yard

DRY MEASURE, U. S.

		Cu. In.
2 pints.....1 quart (qt.)	=	67.20
4 quarts.....1 gallon (gal.)	=	268.80
2 gallons, or..... 1 peck	=	537.60
8 quarts.....		
4 pecks.....1 struck bushel	=	2150.42

LIQUID MEASURE, U. S.

	Cu. In.
4 gills.....1 pint (O.)	= 28.875
2 pints.....1 quart (qt.)	= 57.75
4 quarts.....1 gallon (gal.)	= 231
63 gallons.....1 hogshead (hhd.)	
2 hogsheads.....1 pipe or butt	
2 pipes.....1 tun	

APOTHECARIES' LIQUID MEASURE.

Apothecaries' or Wine Measure is used by pharmacists of this country. Its denominations are gallon, pint, fluid ounce, fluid drachm, and minim, as follows:

Cong.		O.		F. Oz.		F. Dr.		Minims
1	=	8	=	128	=	1,024	=	61,440
		1	=	16	=	128	=	7,680
				1	=	8	=	480
						1	=	60
								1

The Imperial Standard Measure is used by British pharmacists. Its denominations and their relative value are:

Gal.		Quarts.		Pints.		F. Oz.		F. Dr.		Minims
1	=	4	=	8	=	160	=	1,280	=	76,800
		1	=	2	=	40	=	320	=	19,200
				1	=	20	=	160	=	9,600
						1	=	8	=	480
								1	=	60

The relative value of United States Apothecaries' and British Imperial Measures is as follows:

U. S. Apothecaries' Measure.		⌐Imperial Measure.¬ Pints.	F. Oz.	F. Dr.	Minims
1 Gallon	= .83311 Gallon, or	6	13	2	22.85
1 Pint	= .83311 Pint, or		16	5	17.86
1 Fl. Oz.	= 1.04139 Fl. Oz., or		1	0	19.86
1 Fl. Dr.	= 1.04139 Fl. Dr. or			1	2.48
1 Minim	= 1.04139 Minim, or				1.04

OLD WINE AND SPIRIT MEASURE.

		Imperial Gals.
4 gills or quarterns...1 pint		
2 pints.....1 quart		
4 quarts (231 cu. in.).1 gallon	=	.8333
10 gallons.....1 anchor	=	8.333
18 gallons.....1 bunlet	=	15
31½ gallons.....1 barrel	=	26.25
42 gallons.....1 tierce	=	35
63 gallons, or..... 1 hogshead	=	52.5
2 barrels.....		
84 gallons, or..... 1 puncheon	=	70
1½ hogsheads.....		
126 gallons, or..... 1 pipe or butt	=	105
2 hogsheads, or...		
1½ puncheons.....		
2 pipes or..... 1 tun	=	210
3 puncheons.....		

Apothecaries' Weight is the official standard of the United States Pharmacopœia. In buying and selling medicines not ordered by prescriptions avoirdupois weight is used.

Lb.		Oz.		Dr.		Scr.		Gr.
1	=	12	=	96	=	288	=	5760
		1	=	8	=	24	=	480
				1	=	3	=	60
						1	=	20

WEIGHTS AND MEASURES—*Continued*

Avoirdupois Weight.—Used for weighing all goods except those for which troy and apothecaries' weight are employed.

Gross or Long Ton.	Cwt.	Qr.	Lb.	Oz.	Dr.
1 =	20 =	80 =	2,240 =	35,840 =	573,440
1 =	4 =	112 =	1,792 =	28,672	
1 =	28 =	448 =	7,168		
1 =	16 =	256			
1 =	16				

Short or Net Ton.	Cwt.	Qr.	Lb.	Oz.	Dr.
1 =	20 =	80 =	2,000 =	32,000 =	512,000
1 =	4 =	100 =	1,600 =	25,600	
1 =	25 =	400 =	6,400		
1 =	16 =	256			
1 =	16				

The "short" ton of 2,000 lbs. is used commonly in the United States. The British or "long" ton, used to some extent in the United States, contains 2,240 lbs., corresponding to a cwt. of 112 and a quarter of 28 lbs.

Troy Weight.—Used by jewelers and at the mints, in the exchange of the precious metals.

Lb.	Oz.	Dwt.	Gr.
1 =	12 =	240 =	5760
1 =	20 =	480	
1 =	24		

700 troy grains = 1 lb. avoirdupois.
175 troy pounds = 144 lb. avoirdupois.
175 troy ounces = 192 oz. avoirdupois.
437½ troy grains = 1 oz. avoirdupois.
1 troy pound = .8228 + lb. avoirdupois.

The common standard of weight by which the relative values of these systems are compared is the grain, which for this purpose may be regarded as the unit of weight. The pound troy and that of apothecaries' weight have each five thousand seven hundred and sixty grains; the pound avoirdupois has seven thousand grains.

The relative proportions and values of these several systems are as follows:

Troy.	Avoirdupois. Oz.	Dr.
1 pound equals	13	2.65
1 ounce equals	1	1.55
1 dwt. equals	0	0.877

Troy.	Apothecaries'. Lb.	Oz.	Dr.	Sc.	Gr.
1 pound equals	1	0	0	0	0
1 ounce equals	0	1	0	0	0
1 dwt. equals	0	0	0	1	4
1 grain equals	0	0	0	0	1

Apothecaries'.	Avoirdupois. Oz.	Dr.
1 pound equals	13	2.65
1 ounce equals	1	1.55
1 drachm equals	0	2.19
1 scruple equals	0	0.73

Apothecaries'.	Troy. Lb.	Oz.	Dwt.	Gr.
pound equals	1	0	0	0
ounce equals	0	1	0	0
drachm equals	0	0	2	12
scruple equals	0	0	0	20

Avoirdupois.	Troy. Lb.	Oz.	Dwt.	Gr.
1 long ton equals	2722	2	13	8
1 cwt. equals	136	1	6	16
1 quarter equals	34	0	6	16
1 pound equals	1	2	11	16
1 ounce equals		0	18	5½
1 drachm equals		0	1	3 11/32

Avoirdupois.	Troy. Lb.	Oz.	Dwt.	Gr.
1 short ton equals	2430	6	13	8
1 cwt. equals	121	6	6	16
1 quarter equals	30	4	11	16

Avoirdupois.	Apothecaries'. Lb.	Oz.	Dr.	Scr.	Gr.
1 pound equals	1	2	4	2	0
1 ounce equals	0	0	7	0	17½
1 drachm equals	0	0	0	1	7 11/32

DIAMOND MEASURE.

16 parts = 1 grain = 0.8 troy grain.
4 grains = 1 carat = 3.2 troy grains.

TIME.

The unit of time measurement is the same among all nations. Practically it is 1/86400 of the mean solar day, but really it is a perfectly arbitrary unit, as the length of the mean solar day is not constant for any two periods of time. There is no constant natural unit of time.

1 minute	= 60 seconds.
1 hour	= 60 minutes, 3600 seconds.
1 day	= 24 hours, 1440 minutes, 86,400 seconds.
1 sidereal day	= 86164.1 seconds.
1 sidereal month	= 27.321661 mean solar days (average).
1 lunar month	= 29.530589 mean solar days (average).
1 anomalistic month	= 27.544600 mean solar days (average).
1 tropical month	= 27.321582 mean solar days (average).
1 nodical month	= 27.212222 mean solar days (average.)
Mean solar year	= 365 d. 5 h. 48 m. 46.045 s. with annual variation of 0.00539.

The change in the length of the mean sidereal day, i.e., of the time of the earth's rotation upon its axis, amounts to 0.01252 s. in 2400 mean solar years.

ANGULAR MEASURE

60 seconds = 1 minute
60 minutes = 1 degree
60 degrees = 1 sextant
90 degrees = 1 right angle or quadrant
360 degrees = 1 circle

GEOGRAPHICAL MEASURE

6087.15	feet = 1 geographical mile
1.15287	statute miles = 1 geographical mile
60	geographical miles = 1 degree of longitude at the Equator
69.168	statute miles = 1 degree of longitude at the Equator
360	degrees = circumference of earth at the Equator

WEIGHTS AND MEASURES—*Continued*

NAUTICAL MEASURE

6	feet = 1 fathom
120	fathoms = 1 cable length
6080.27	feet = 1 nautical mile
1000	fathoms = 1 nautical mile
1.15157	statute miles = 1 nautical mile
3	nautical miles = 1 league
1	knot = a speed of 1 nautical mile per hour

In the United States the nautical mile is defined to be one sixtieth part of the length of a degree of a great circle of a sphere whose surface is equal in area to the area of the surface of the earth. In France, Germany and Austria the nautical mile has a length of 6,076.23 feet. In England the nautical mile is 6,080 feet.

Miles at sea are understood to be nautical miles. Therefore it is no more necessary to say "nautical" miles when speaking of a sea distance than to say "statute" miles when speaking of a land distance.

Landsmen are apt to confuse knots with nautical miles. A knot is not a measure of distance but a measure of speed, and the only measure of speed in the English language. When speaking of a vessel that travels, say 20 knots, we mean that the vessel is traveling at a speed of 20 nautical miles per hour; but the distance covered may be one nautical mile or a thousand, depending upon the length of time during which the 20-knot speed is maintained. Only landsmen use the expression "knots per hour." The "per hour" is superfluous and incorrect.

Following is a list of the lighthouses from Bremerhaven to Dover; figures expressed in sea miles. There is no table in existence which exactly corresponds with the excellent tables which we give from Fastnet Light to Flushing.

Hoheweg-Lighthouse	17
Rothesand-Lighthouse	26
Weser-Lightship	35
Borkum Lightship	100
Terschelling Lightship	146
Dover	340

PERPETUAL CALENDAR.

To find the day of the week for any given date.

1. Take the last two figures of the year, add ¼ of them (neglecting remainder). Thus: 1949 = 49 + 12 = 61.

2. Add for the month, if for Jan. or Oct., 1; May, 2; Aug., 3; Feb., Mar., or Nov., 4; June, 5; Sept. or Dec., 6; April or July, 0; if leap year (that is, if it be divisible by 4 without remainder) Jan., 0; Feb., 3.

3. Add day of month.

Divide the sum of these three by 7, and *remainder* gives the number of the day of the week.

Thus:—
What day of the week is 15th July, 1908?

1. 8 + 2 = 10
2. July = 0
3. 15th = 15

$25 = 7 \times 3 + 4.$

4th day of the week = Wednesday.

What day of the week was December 25th, 1905?

1. 5 + 1 = 6
2. Dec. = 6
3. 25th = 25

$37 = 7 \times 5 + 2.$

2nd day of the week = Monday.

The above only applies to 20th Century. For 19th Century, add 2, for 21st Century, add 6, 18th Century, 4, but before 1752 the "old style" was used.

DISTANCES IN DETAIL OF AMERICAN LIGHTS.

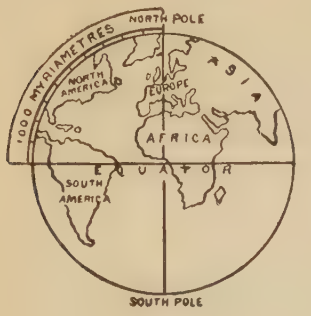
	Knots
New York to Sandy Hook	18
Sandy Hook to Ambrose Lightship	8
Ambrose Lightship to Fire Island	30
Fire Island to Shinnecock	35
Shinnecock to Nantucket Lightship	122

TABLE FOR CONVERTING NAUTICAL MILES TO STATUTE MILES.

Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles	Nautical Miles	Statute Miles
1	1.152	14	16.122	27	31.092	40	46.063
2	2.303	15	17.274	28	32.244	41	47.214
3	3.455	16	18.425	29	33.396	42	48.366
4	4.606	17	19.577	30	34.547	43	49.518
5	5.758	18	20.728	31	35.699	44	50.670
6	6.909	19	21.880	32	36.850	45	51.821
7	8.061	20	23.031	33	38.002	46	52.972
8	9.213	21	24.183	34	39.153	47	54.124
9	10.364	22	25.335	35	40.305	48	55.275
10	11.516	23	26.486	36	41.457	49	56.427
11	12.667	24	27.638	37	42.608	50	57.578
12	13.819	25	28.789	38	43.760		
13	14.970	26	29.941	39	44.911		

DECIMAL SYSTEM—WEIGHTS AND MEASURES.

A *meter* is one ten-millionth of the distance from the equator to the North Pole.



The metric system, formed on the meter as the unit of length, has four other leading units, all connected with and dependent upon this. The *are*, the unit of surface, is the square of ten meters. The *liter*, the unit of capacity, is the cube of a tenth part of the meter. The *stere*, the unit of solidity, has the capacity of a cubic meter. The *gram*, the unit of weight, is the weight of that quantity of distilled water at its maximum density which fills the cube of a hundredth part of the meter. Each unit has its decimal multiple and sub-multiple, that is, weights and measures ten times larger or ten times smaller than the principal unit. The prefixes denoting the multiples are derived from the Greek, and are *deca*, ten; *hecto*, hundred; *kilo*, thousand; and *myria*, ten thousand. Those denoting sub-multiples are taken from the Latin, and are *deci*, ten; *centi*, hundred; *milli*, thousand.

Relative Value.	Length.	Surface.	Capacity.	Solidity.	Weight.
10,000.	Myriameter				
1,000.	Kilometer		Kiloliter		Kilogram
100.	Hectometer	Hectare	Hectoliter		Hectogram
10.	Decameter		Decaliter	Dekastere	Decagram
Unit.	Meter	Are	Liter	Stere	Gram
0.1.	Decimeter	Deciare	Deciliter	Decistere	Decigram
0.01.	Centimeter	Centiare	Centiliter		Centigram
0.001.	Millimeter		Milliliter		Milligram

APPROXIMATE EQUIVALENTS OF THE FRENCH (METRIC) AND ENGLISH MEASURES.

1 yard	$\frac{11}{12}$ meter.
11 meters	12 yards.
To convert meters into yards	Add $\frac{1}{11}$th.
1 meter = 1.1 yd.; 3.3 ft.	3 ft. $3\frac{3}{8}$ inches ($\frac{1}{32}$th less), 40 inches (1.6 per cent less).
1 meter, by the Standards Commission	= 39.38203 inches.
1 meter, by the Act of 1878	= 39.37079 inches.
1 foot	3 decimeters (more exactly 3.048).
1 inch	25 millimeters (more exactly 25.4).
1 mile	1.6 or $1\frac{3}{5}$ kilometers (more exactly 1.60931).
1 kilometer	$\frac{5}{8}$ of a mile.
1 chain (22 yards)	20 meters (more exactly 20.1165).
5 furlongs (1,100 yards)	1 kilometer (more exactly 1.0058).
1 square yard	$\frac{9}{10}$ square meter (more exactly .8361).
1 square meter	$10\frac{3}{4}$ square feet, $1\frac{1}{5}$ square yards.
1 square inch	$6\frac{1}{2}$ square centimeters (more exactly 6.45).
1 square mile (640 acres)	260 hectares (0.4 per cent less).
1 acre (4840 square yards)	4000 square meters (1.2 per cent more).
1 cubic yard	$\frac{3}{4}$ cubic meter (2 per cent more).
1 cubic meter	$1\frac{1}{3}$ cubic yards ($1\frac{3}{4}$ per cent less).
1 cubic meter	$35\frac{1}{3}$ cubic feet (.05 per cent less).
1 cubic meter of water	1 long ton nearly.
1 kilogram	2.2 pounds fully.
1,000 kilograms, 1 metric ton	1 long ton nearly.
1 long hundredweight	51 kilograms nearly.
1 United States hundredweight	$45\frac{1}{2}$ kilograms nearly.

METRIC MEASURES.

Measures.	Metric to Customary.			Customary to Metric.		
LENGTHS	1 Millimeter	= 0.03937	inch	1 Inch	= 25.4001	millimeters
	1 Centimeter	= 0.3937	"	1 "	= 2.54001	centimeters
	1 Meter	= 39.37	"	1 "	= 0.0254	meter
	1 "	= 3.28083	feet	1 Foot	= 0.304801	"
	1 "	= 1.093611	yards	1 Yard	= 0.914402	"
	1 Kilometer	= 0.62137	mile	1 Mile	= 1.60935	kilometers
AREAS	1 Square Millimeter	= 0.00155	square inch	1 Square Inch	= 645.16	square millimeters
	1 " Centimeter	= 0.1550	" "	1 " "	= 6.452	" centimeters
	1 " Meter	= 10.764	" feet	1 " Foot	= 0.0929	" meter
	1 " "	= 1.1960	" yards	1 " Yard	= 0.8361	" "
	1 " Kilometer	= 0.3861	" mile	1 " Mile	= 2.5900	" kilometers
	1 Hectare	= 2.471	acres	1 Acre	= 0.4047	hectares
VOLUMES	1 Cubic Millimeter	= 0.000061	cubic inch	1 Cubic Inch	= 16,387.2	cubic millimeters
	1 " Centimeter	= 0.0610	" "	1 " "	= 16.3872	" centimeters
	1 " Meter	= 35.314	" feet	1 " Foot	= 0.02832	" meter
	1 " "	= 1.3079	" yard	1 " Yard	= 0.7645	" "
CAPACITY. *Liquid*	1 Liter	= 1.05668	quarts	1 Quart	= 0.94636	liter
	1 "	= 0.26417	gallon	1 Gallon	= 3.78543	"
Dry	1 Liter	= 0.9081	quart	1 Quart	= 1.1012	liters
	1 "	= 0.11351	peck	1 Peck	= 8.80982	"
	1 Decaliter	= 1.1351	"	1 "	= 0.8810	decaliter
	1 Hectoliter	= 2.83774	bushels	1 Bushel	= 0.35239	hectoliter
MASSES. *Avoirdupois*	1 Gram	= 15.4324	grains	1 Grain	= 0.06480	gram
	1 "	= 0.03527	ounce	1 Ounce	= 28.3495	"
	1 Kilogram	= 2.20462	pounds	1 Pound	= 0.45359	kilogram
Troy	1 Gram	= 0.03215	ounce	1 Ounce.	= 31.10348	grams
	1 Kilogram	= 2.67923	pounds	1 Pound	= 0.37324	kilogram
Apothecaries'	1 Gram	= 0.2705	dram	1 Dram	= 3.6967	grams
	1 "	= 0.8115	scruple	1 Scruple	= 1.2322	"

KILOMETRES AND MILES.

Kil.	Miles.	Kil.	Miles.	Kil.	Miles.	Kil.	Miles.
1 = about	⅝	29 = about	18	57 = about	36.1	85 = about	53.3
2 "	1¼	30 "	18⅝	58 "	36.7	86 "	54
3 "	1⅞	31 "	19.7	59 "	37.3	87 "	54⅝
4 "	2½	32 "	20	60 "	38	88 "	55.2
5 "	3.1	33 "	20⅝	61 "	38.9	89 "	55
6 "	3¾	34 "	21.2	62 "	39.2	90 "	56½
7 "	4.7	35 "	21¾	63 "	39¾	91 "	56¾
8 "	5	36 "	22½	64 "	40.4	92 "	57.4
9 "	5⅝	37 "	23 1	65 "	41	93 "	58
10 "	6.2	38 "	23.7	66 "	41.9	94 "	58 1-5
11 "	6¾	39 "	24.3	67 "	42.2	95 "	59⅛
12 "	7½	40 "	24.8	68 "	42¾	96 "	59 5-6
13 "	8.1	41 "	25 1-3	69 "	43	97 "	60½
14 "	8.7	42 "	26½	70 "	43.9	98 "	61.1
15 "	9.3	43 "	27.1	71 "	44.2	99 "	61.8
16 "	10	44 "	27⅜	72 "	44¾	100 "	62.1
17 "	10.9	45 "	28.7	73 "	45⅜	200 "	124.3
18 "	11.2	46 "	29	74 "	46	300 "	186
19 "	11¾	47 "	29⅝	75 "	46.6	400 "	248½
20 "	12.4	48 "	30.2	76 "	47½	500 "	310.7
21 "	13	49 "	30¾	77 "	47 5-6	600 "	372.8
22 "	13.6	50 "	31⅛	78 "	48½	700 "	435
23 "	14½	51 "	32.7	79 "	49.1	800 "	497.1
24 "	14 5-6	52 "	33	80 "	49.6	900 "	559.1
25 "	15½	53 "	33⅝	81 "	50⅜	1000 "	621.8
26 "	16.1	54 "	34.2	82 "	51½		
27 "	16⅜	55 "	34¾	83 "	52.1		
28 "	17.7	56 "	35½	84 "	52.7		

TABLE OF DECIMAL EQUIVALENTS OF FRACTIONS OF AN INCH.

1/64	= ·015625	11/32	= ·34375	43/64	= ·671875
1/32	= ·03125	23/64	= ·359375	11/16	= ·6875
3/64	= ·046875	3/8	= ·375	45/64	= ·703125
1/16	= ·0625	25/64	= ·390625	23/32	= ·71875
5/64	= ·078125	13/32	= ·40625	47/64	= ·734375
3/32	= ·09375	27/64	= ·421875	3/4	= ·75
7/64	= ·109375	7/16	= ·4375	49/64	= ·765625
1/8	= ·125	29/64	= ·453125	25/32	= ·78125
9/64	= ·140625	15/32	= ·46875	51/64	= ·796875
5/32	= ·15625	31/64	= ·484375	13/16	= ·8125
11/64	= ·171875	1/2	= ·50	53/64	= ·828125
3/16	= ·1875	33/64	= ·515625	27/32	= ·84375
13/64	= ·203125	17/32	= ·53125	55/64	= ·859375
7/32	= ·21875	35/64	= ·546875	7/8	= ·875
15/64	= ·234375	9/16	= ·5625	57/64	= ·890625
1/4	= ·25	37/64	= ·578125	29/32	= ·90625
17/64	= ·265625	19/32	= ·59375	59/64	= ·921875
9/32	= ·28125	39/64	= ·609475	15/16	= ·9375
19/64	= ·296875	5/8	= ·625	61/64	= ·953125
5/16	= ·3125	41/64	= ·640625	31/32	= ·96875
21/64	= ·328125	21/32	= ·65625	63/64	= ·984375

WEIGHT OF BELLS.

Kremlin, Moscow, Russia	432,000	lbs.
Mengoon, Burmah, India	201,600	"
St. Ivans, Moscow, Russia	127,350	"
Great Bell of Pekin, China	120,000	"
Maha Ganda, Burmah, India	95,000	"
Nishni Novgorod, Russia	69,664	"
Church of the Redeemer, Moscow, Russia	60,736	"
St. Paul's, London, England	42,000	"
Olmutz, Bohemia, Austria	40,320	"
Vienna, Austria	40,200	"
Westminster, London, England, St. Stephen's Tower, House of Parliament	35,620	"
Erfurt, Saxony, Germany	30,800	"
Notre Dame, Paris, France	28,670	"
Montreal, Canada	28,560	"
City Hall, New York, U. S. A.	22,500	"

Liberty Bell, Philadelphia, U. S. A.

The three towers of the Houses of Parliament stand up from behind Westminster Hall. On the left next to Westminster Bridge is the Clock Tower (St. Stephen's Tower), (Darlington's London), containing the enormous bell known as "Big Ben."—See Ency. Britannica, p. 539. Big Ben (cracked), bet. 13 and 14 tons.

LENGTH OF CELEBRATED BRIDGES.

NAME.	Longest Span.	Total Length.	Type.	Spanning.
Forth, Scotland	1710	8,296	Cantilever	Firth of Forth
Williamsburg, N. Y.	1600	7,200	Suspension	East River
Brooklyn, N. Y.	1595½	5,986	"	"
Manhattan, N. Y.	1470	9,900	"	"
Queensboro, N. Y.	1182	7,450	Cantilever	"
Niagara (Low Falls), N. Y.	821	1,040	Suspension	Niagara River
Niagara, N. Y.	550	910	Cantilever	"
Washington Bridge, N. Y.	509	2,300	Composite	Harlem River
Firth of Tay, Scotland	245	10,779	Girder	Firth of Tay

STATUTORY WEIGHTS OF THE BUSHEL.

Courtesy of "International Harvester Company Almanac and Encyclopedia."

STATE OR TERRITORY	Wheat	Rye	Oats	Barley	Buckwheat	Shelled corn	Corn on cob	Cornmeal unbolt	Bran	Malt	Potatoes, Irish	Potatoes, sweet	Carrots	Onions	Turnips, English	Beets	Beans	Peas	Apples	Dried apples	Dried peaches	Castor beans	Flaxseed	Hemp seed	Millet seed	Timothy seed	Blue grass seed	Hungarian grass sd.	Clover seed
United States	60	56	32	48	42	..	..	48	..	34	60	..	..	..	..	..	..	60	..	..	..	50	56	..	..	..	..	..	..
Alabama	60	56	32	47	..	56	70	48	..	..	..	60	55	..	..	55	..	60	60	..	24	33	..	..	..	..	..	..	..
Alaska	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Arizona	60	56	32	45	..	..	..	..	..	..	..	..	..	..	..	..	55	..	..	..	..	..	..	..	..	..	..	..	..
Arkansas	60	56	32	48	52	56	70	48	20	..	60	50	..	57	57	..	60	60	50	24	33	..	56	..	50	60	14	..	60
California	60	54	32	50	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Colorado	60	56	32	48	52	..	70	50	..	..	60	..	..	57	..	..	60	..	..	..	..	..	..	44	..	45	14	..	60
Connecticut	60	56	32	48	48	..	..	50	20	..	60	54	50	52	50	60	60	60	60	48	25	33	..	55	..	..	..	..	60
Delaware	60	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dist. Col	60	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Florida	60	56	32	48	..	56	70	48	20	..	60	60	..	56	54	..	60	..	48	24	..	48	..	..	50	..	..	..	..
Georgia	60	56	32	47	52	56	70	48	20	..	60	55	..	57	55	..	60	60	..	24	33	..	56	44	..	45	14	..	60
Hawaii	60	56	32	48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Idaho	60	56	36	48	42	..	..	..	..	..	60	..	..	..	..	..	..	..	45	28	28	..	56	..	..	..	..	..	60
Illinois	60	56	32	48	52	56	70	48	20	38	60	50	..	57	55	..	60	..	..	24	33	46	56	44	..	45	14	..	60
Indiana	60	56	32	48	50	56	68	50	..	35	60	55	..	48	55	..	60	..	..	25	33	46	..	44	50	45	14	..	60
Iowa	60	56	32	48	52	56	70	..	20	..	60	46	..	57	..	..	60	..	48	24	33	46	56	44	50	45	14	50	60
Kansas	60	56	32	48	50	..	70	50	20	32	60	50	..	57	55	..	60	..	48	24	33	46	56	44	50	45	14	50	60
Kentucky	60	56	32	47	56	56	70	50	20	..	60	55	..	57	60	..	60	60	..	24	..	45	56	44	50	45	14	50	60
Louisiana	60	56	..	48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Maine	60	50	32	48	48	..	..	50	..	..	60	..	50	52	50	60	60	60	44	..	..	..	..	..	..	..	..	..	..
Maryland	..	..	26	..	..	..	..	..	..	..	56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Massachusetts	60	56	32	48	48	50	..	50	20	..	60	54	50	52	..	..	60	60	48	25	..	..	55	..	..	45	..	..	60
Michigan	60	56	32	48	48	56	70	50	..	..	60	56	..	54	58	..	60	60	48	22	..	46	56	44	50	45	14	50	60
Minnesota	60	56	32	48	50	56	70	..	..	..	60	56	45	52	..	50	60	60	60	50	28	..	..	..	50	48	45	14	48	60
Mississippi	60	56	32	48	48	56	72	48	20	38	60	60	..	57	55	..	60	60	..	26	..	46	56	44	50	45	14	50	60
Missouri	60	56	32	48	52	56	70	50	20	38	60	56	50	57	42	..	60	60	48	24	..	46	56	44	50	45	14	48	60
Montana	60	56	32	48	52	56	70	50	20	30	60	..	50	57	..	50	60	60	45	..	..	..	56	44	..	45	14	50	60
Nebraska	60	56	32	48	52	56	70	50	20	30	60	50	..	57	55	..	60	60	..	24	..	46	56	44	50	45	14	50	60
Nevada	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New Hampshire	60	56	32	..	..	..	..	50	..	..	60	..	..	..	..	..	62	60	..	..	..	..	..	..	..	..	..	..	..
New Jersey	60	56	30	48	50	..	..	..	..	..	60	54	..	57	..	..	60	60	50	25	..	..	55	..	..	..	..	..	64
New Mexico	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New York	60	56	32	48	48	..	..	50	20	..	60	54	50	57	..	..	60	60	48	25	..	..	55	..	..	45	..	..	60
North Carolina	60	56	32	48	50	..	..	48	..	..	..	..	..	..	..	..	..	60	..	..	..	..	55	..	..	..	..	..	60
North Dakota	60	56	32	48	42	56	70	..	20	..	60	46	..	52	60	60	60	60	50	..	..	..	56	..	50	45	..	..	60
Ohio	60	56	32	48	50	56	68	..	..	34	60	50	50	55	60	56	60	60	50	24	..	..	56	44	50	45	..	50	60
Oklahoma	60	56	32	48	42	56	70	..	20	..	60	46	..	52	60	60	60	60	..	..	..	..	56	..	..	42	..	..	60
Oregon	60	56	32	46	42	..	..	..	..	..	60	..	..	..	..	..	..	..	45	28	..	..	..	..	..	..	..	..	60
Pennsylvania	60	56	32	47	48	..	..	..	..	..	56	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
Rhode Island	60	56	32	48	48	56	70	50	20	38	60	54	50	50	50	50	60	60	48	25	..	46	56	44	50	45	..	50	60
South Carolina	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Dakota	60	56	32	48	42	56	70	..	20	..	60	46	..	52	60	60	60	60	..	..	..	..	56	..	..	42	..	..	60
Tennessee	60	56	32	48	50	56	70	48	20	..	60	50	50	56	50	50	60	60	50	24	..	46	56	44	50	45	14	48	60
Texas	60	56	32	48	42	56	70	..	20	..	60	55	..	57	55	..	60	..	45	28	..	..	56	44	50	45	..	48	60
Utah	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Vermont	60	56	32	48	48	56	..	..	..	..	60	..	50	52	60	60	62	60	46	..	..	..	..	..	..	45	..	..	60
Virginia	60	56	30	48	52	56	70	50	..	38	56	56	..	57	55	..	60	60	..	28	32	..	56	44	50	45	14	48	60
Washington	60	56	32	48	42	..	..	..	..	..	60	..	..	..	..	..	..	..	45	28	..	..	56	..	..	..	..	..	60
West Virginia	60	56	32	48	52	..	..	..	..	..	60	..	..	..	..	..	60	..	..	25	..	..	56	..	..	45	..	..	60
Wisconsin	60	56	32	48	50	..	..	50	20	34	60	54	50	57	42	50	60	60	50	25	..	..	56	44	50	45	..	48	60
Wyoming	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

NOTE.— Rye meal takes 48 pounds to the bushel in the District of Columbia and 50 in Maine, Massachusetts, New York, Rhode Island, and Wisconsin. Peeled dried peaches take 38 pounds to the bushel in Alabama and 40 in Virginia. The metric system is used in the Philippines and Porto Rico.

STEAM PRESSURE AND TEMPERATURE.

Pressure in Lbs. per Sq. In.	Corresponding Temperature, Fahrenheit.	Pressure in Lbs. per Sq. In.	Corresponding Temperature, Fahrenheit.	Pressure in Lbs. per Sq. In.	Corresponding Temperature, Fahrenheit.
10	192.4	65	301.3	140	357.9
15	212.8	70	306.4	150	363.4
20	228.5	75	311.2	160	368.7
25	241.0	80	315.8	170	373.6
30	251.6	85	320.1	180	378.4
35	260.9	90	324.3	190	382.9
40	269.1	95	328.2	200	387.3
45	276.4	100	332.0	210	391.5
50	283.2	110	339.2	220	395.5
55	289.3	120	345.8	230	399.4
60	295.6	130	352.1	240	403.1

TABLE OF TEMPERATURE.

Degree of Fahr.	
2,786	Cast iron melts (Daniell).
1,996	Copper melts (Daniell).
1,947	Gold melts.
1,873	Silver melts (Daniell).
1,750	Brass (containing 25% of zinc) melts (Daniell).
1,000	Iron, bright cherry red (Poillet).
980	Red heat, visible in daylight (Daniell).
941	Zinc begins to burn (Daniell).
773	Zinc melts (Daniell).
644	Mercury boils (Daniell), 662 (Graham).
640	Sulphuric acid boils (Magrignac), 620 (Graham).
630	Whale oil boils (Graham).
617	Pure lead melts (Rudberg).
600	Linseed oil boils.
518	Bismuth melts (Gmelin).
442	Tin melts (Crichton).
380	Arsenious acid volatilizes.
356	Metallic arsenic sublimes.
315	Oil of turpentine boils (Kaure).
302	Etherification ends.
257	Saturated sol. of sal ammoniac boils (Taylor).
256	Saturated sol. of acetate of soda boils.
239	Sulphur melts (Miller), 226 (Fownes).
238	Saturated sol. of nitre boils.
221	Saturated sol. of salt boils (Paris Codex).
220	Saturated sol. of alum, carb. soda, and sulph. zinc, boil.
218	Saturated sol. of chlorate and prussiate potash, boil.
216	Saturated sol. of sulph. iron, sulph. copper, nitrate of lead, boil.
214	Saturated sol. of acetate lead, sulph. and bitartrate potash, boil.
213 or (213.5)	Water begins to boil in glass.
212	Water boils in metal, barometer at 30°.

Degree of Fahr.	
211	Alloy of 5 bismuth, 3 tin, 2 lead, melts.
201	Alloy of 8 bismuth, 5 lead, 3 tin, melts (Kane).
207	Sodium melts (Regnault).
185	Nitric acid 1.52 begins to boil.
180 (about)	Starch forms a gelatinous compound with water.
176	Rectified spirit boils, benzol distils.
173	Alcohol (sp. gr. .796 to .800) boils.
151	Beeswax melts (Kane), 142 (Lepage).
150	Pyroxylic spirit boils (Scanlan).
145	White of egg begins to coagulate.
141.8	Chloroform, and ammonia of .945, boil.
132	Acetone (pyroacetic spirit) boils (Kane).
122	Mutton suet and styracin melt.
116	Bisulphuret of carbon boils (Graham).
115	Pure tallow melts (Lepage), 92 (Thomson).
112	Spermaceti and stearin of lard melt.
111	Phosphorus melts (Miller).
98	Temperature of the blood.
95	Ether (.720) boils.
95	Carbolic acid crystals become an oily liquid.
88	Acetous fermentation ceases, water boils *in vacuo*.
77	Vinous ferm. ends, acetous ferm. begins.
64.4	Oil of anise liquefies.
59	Gay Lussac's *Alcoomètre* graduated at.
55	Sirups to be kept at.
30 (about)	Olive oil becomes partially solid.
32	Water freezes.
5	Cold produced by snow 2 parts and salt 1 part.
−37.9	Mercury freezes.

—*Cooley.*

APPROXIMATE PERCENTAGE VARIATION IN RESISTANCE AT ABOUT 20° C. (68° F.)

Metal or Alloy.	(a) Per 1° C.	(a) Per 1° F.
Platinum Silver (1 pt. Platinum to 2 pts. Silver), hard or annealed	0.031	0.017
German Silver, hard or annealed	0.044	0.024
Mercury	0.072	0.040
Bismuth, pressed	0.354	0.197
Gold, annealed	0.365	0.203
Zinc, pressed	0.365	0.203
Tin, "	0.365	0.203
Silver, annealed	0.377	0.209
Lead, pressed	0.387	0.215
Copper, annealed	0.428	0.238
Iron (about)	0.5	0.278

—*Practical Engineer's Electrical Pocket-Book and Diary.*

HEAT AND ELECTRICAL CONDUCTIVITY.

Substances.	Heat Conductivity.	Electrical Conductivity.
Silver	100.0	100.0
Copper	73.6	73.3
Gold	53.2	58.5
Brass	23.6	21.5
Zinc	19.9	....
Tin	14.5	22.6
Steel	12.0	....
Iron	11.9	13.0
Lead	8.5	10.7
Platinum	6.4	10.3
Palladium	6.3	....
Bismuth	1.8	1.9

RESISTANCE AND WEIGHT TABLE.

American gauge for cotton and silk-covered and bare copper wire.—The resistances are calculated for pure copper wire.

The number of feet to the pound is only approximate for insulated wire.

No.	Diameter.	Feet per Pound.			Resistance, Naked Copper.			
		Cotton Covered.	Silk Covered.	Naked.	Ohms per 1,000 Feet.	Ohms per Mile.	Feet per Ohm.	Ohms per Pound.
8	.12849	.....	.....	20	6259	3.3	1600	.0125
9	.11443	.....	.....	25	.7892	4.1	1272	.0197
10	.10189	.....	.....	32	.8441	4.4	1185	.0270
11	.09074	.....	.....	40	1.254	6.4	798	.0501
12	.08081	42	46	50	1.580	8.3	633	.079
13	.07196	55	60	64	1.995	10.4	504	.127
14	.06408	68	75	80	2.504	13.2	400	.200
15	.05707	87	95	101	3.172	16.7	316	.320
16	.05082	110	120	128	4.001	23	230	.512
17	.04525	140	150	161	5.04	26	198	.811
18	.0403	175	190	203	6.36	33	157	1.29
19	.03539	220	240	256	8.25	43	121	2.11
20	.03196	280	305	324	10.12	53	99	3.27
21	.02846	360	390	408	12.76	68	76.5	5.20
22	.02535	450	490	514	16.25	85	61.8	8.35
23	.02257	560	615	649	20.30	108	48.9	13.3
24	.0201	715	775	818	25.60	135	39.0	20.9
25	.0179	910	990	1,030	32.2	170	31.0	33.2
26	.01594	1,165	1,265	1,300	40.7	214	24.6	52.9
27	.01419	1,445	1,570	1,640	51.3	270	19.5	84.2
28	.01264	1,810	1,970	2,070	64.8	343	15.4	134
29	.01126	2,280	2,480	2,617	81.6	432	12.2	213
30	.01002	2,805	3,050	3,287	103	538	9.8	338
31	.00893	3,605	3,920	4,144	130	685	7.7	539
32	.00795	4,535	4,930	5,227	164	865	6.1	856
33	.00708	.....	6,200	6,590	206	1033	4.9	1357
34	.0063	.....	7,830	8,330	260	1389	3.8	2166
35	.00561	.....	9,830	10,460	328	1820	2.9	3521
36	.005	.....	12,420	13,210	414	2200	2.4	5469

WEIGHT IN POUNDS PER MILE OF COPPER WIRE.

Number.	Roebling.	Birmingham.	Brown & Sharpe.	English Legal Standard.	Number.	Roebling.	Birmingham.	Brown & Sharpe.	English Legal Standard.
0000	2,466	3,286	3,375	2,555	14	102	110	65	102
000	2,092	2,884	2,677	2,210	15	83	83	52	83
00	1,750	2,305	2,123	1,933	16	64	68	41	65
0	1,504	1,846	1,684	1,682	17	47	53¼	33	50
1	1,278	1,437	1,335	1,437	18	35	38	26	37
2	1,104	1,287	1,058	1,216	19	27	28	20¾	26
3	950	1,071	839	1,012	20	19½	19½	16¼	20¾
4	808	904	665	860	21	16¼	16¼	13	16¼
5	684	773	528	718	22	12½	12½	10¼	12½
6	588	657	418	588	23	10¼	10¼	8⅛	9¼
7	500	517	332	495	24	8¼	7¾	6½	7¾
8	419	435	263	409	25	6¼	6½	5⅛	6½
9	350	350	209	332	26	5	5	4	5
10	291	287	166	263	27	4¼	4	3¼	4
11	230	230	131	215	28	4	3¼	2½	3¼
12	176	190	104	173	29	3⅛	2⅝	2	3
13	135	144	83	135	30	3¼	2¼	1⅝	2½

WIRE GAUGES, IN DECIMAL PARTS OF AN INCH.

Number of Wire Gauge.	Roebling.	Brown & Sharpe.	Birmingham or Stubs.	English Legal Standard.	Old English, or London.
000000	0.46	.....	.....	0.464	.....
00000	0.43	.....	.....	0.432	.....
0000	0.393	0.46	0.454	0.4	0.454
000	0.362	0.40964	0.425	0.372	0.425
00	0.331	0.3648	0.380	0.348	0.38
0	0.307	0.32495	0.340	0.324	0.34
1	0.283	0.2893	0.3	0.3	0.3
2	0.263	0.25763	0.284	0.276	0.284
3	0.244	0.22942	0.259	0.252	0.259
4	0.225	0.20431	0.238	0.232	0.238
5	0.207	0.18194	0.22	0.212	0.22
6	0.192	0.16202	0.203	0.192	0.203
7	0.177	0.14428	0.18	0.176	0.18
8	0.162	0.12849	0.165	0.16	0.165
9	0.148	0.11443	0.148	0.144	.148
10	0.135	0.10189	0.134	0.128	0.134
11	0.12	0.09074	0.12	0.116	0.12
12	0.105	0.08081	0.109	0.104	0.109
13	0.092	0.07196	0.095	0.092	0.095
14	0.08	0.06408	0.083	0.08	0.083
15	0.072	0.05706	0.072	0.072	0.072
16	0.063	0.05082	0.065	0.064	0.065
17	0.054	0.04525	0.058	0.056	0.058
18	0.047	0.0403	0.049	0.048	0.049
19	0.041	0.03589	0.042	0.04	0.04
20	0.035	0.03196	0.035	0.036	0.035
21	0.032	0.02846	0.032	0.032	0.0315
22	0.028	0.02534	0.028	0.028	0.0295
23	0.025	0.02257	0.025	0.024	0.027
24	0.023	0.0201	0.022	0.022	0.025
25	0.02	0.0179	0.02	0.02	0.023
26	0.018	0.01594	0.018	0.018	0.0205
27	0.017	0.01419	0.016	0.0164	0.01875
28	0.016	0.01264	0.014	0.0148	0.0165
29	0.015	0.01125	0.013	0.0136	0.0155
30	0.014	0 01002	0.012	0.0124	0.01375
31	0.0135	0.00893	0.010	0.0116	0.01225
32	0.013	0.00795	0.009	0.0108	0.01125
33	0.011	0.00708	0.008	0.01	0.01025
34	0.01	0.0063	0.007	0.0092	0.0095
35	0.0095	0.00561	0.005	0.0084	0.009
36	0.009	0.005	0.004	0.0076	0.0075

TABLE INDICATING SIZE, WEIGHT, AND LENGTH OF IRON AND STEEL WIRE.

Gauge Numbers.	Diameter, Ins.	W'ight of 100 Feet. Lbs.	W'ight of One Mile, Lbs.	Feet in 2000 Lbs.	Area, Square Ins.
3–0	.362	34.73	1834	5,759	.102921
2–0	.331	29.04	1533	6,886	.086049
1–0	.307	25.00	1318	8,000	.074023
1	.283	21.23	1121	9,425	.062901
2	.263	18.34	968	10,905	.054325
3	.244	15.78	833	12,674	.046759
4	.225	13.39	707	14,936	.039760
5	.207	11.35	599	17,621	.033653
6	.192	9.73	514	20,555	.028952
7	.177	8.30	439	24,906	024605
8	.162	6.96	367	28,734	.020612
9	.148	5.80	306	34,483	.017203
10	.135	4.83	255	41,408	.014313
11	.120	3.82	202	52,356	.011309
12	.105	2.92	154	68,493	.008659
13	.092	2.24	118	89,286	.006647
14	.080	1.69	89	118,343	.005026
15	.072	1.37	72	145,985	.004071
16	.063	1.05	55	190,476	.003117
17	.054	0.77	41	259,740	.002290
18	.047	0.58	31	344,827	.001734
19	.041	0.45	24	444,444	.001320
20	.035	0.32	17	625,000	.000962
21	.032	0.27	14	740,741	.000804
22	.028	0.21	11	952,381	.000615
23	.025	0.175	9.24	.....	.000491
24	.023	0.140	7.39	.....	.000415
25	.020	0.116	6.124	.....	.000314
26	.018	0.093	4.91	.....	.000254
27	.017	0.083	4.382	.....	.000227
28	.016	0.074	3.907	.....	.000201
29	.015	0.061	3.22	.....	.000176
30	.014	0.054	2.851	.....	.000154
31	.0135	0.050	2.64	.....	.000143
32	.013	0.046	2.428	.....	.000132
33	.011	0.037	1.953	.....	.000095
34	.010	0.030	1.584	.....	.000078
35	.0095	0.025	1.32	.....	.000071
36	.009	0.021	1.161	.....	.000064

LINEAR EXPANSION OF SOLIDS AT ORDINARY TEMPERATURES.

Substance.	For 1° Fahr. Length = 1.	For 1° Cent. Length = 1.
Aluminium (cast)	.00001234	.00002221
Antimony (cryst.)	.00000627	.00001129
Brass, cast	.00000957	.00001722
" English plate	.00001052	.00001894
" sheet	.00001040	.00001872
Brick, best stock	.00000310	.00000550
Bronze (Baily's): Copper, 17. Tin, 2½. Zinc, 1.	.00000986	.00001774
"	.00000975	.00001755
Cement, Roman, dry	.00000797	.00001435
Cement, Portland (mixed), pure	.00000594	.00001070
Cement, Portland, mortar, with sand	.00000656	.00001180
Concrete: cement mortar and pebbles	.00000795	.00001430
Copper	.00000887	.00001596
Ebonite	.00004278	.00007700
Glass, English flint	.00000451	.00000812
" French flint	.00000484	.00000872
" white, free from lead	.00000492	.00000886
" blown	.00000498	.00000896
" thermometer	.00000499	.00000897
" hard	.00000397	.00000714
Granite, gray, dry	.00000438	.00000789
" red "	.00000498	.00000897
Gold, pure	.00000786	.00001415
Iridium, pure	.00000356	.00000641
Iron, wrought	.00000648	.00001166
" Swedish	.00000636	.00001145
" cast	.00000556	.00001001
" soft	.00000626	.00001126
Lead	.00001571	.00002828
Marble, moist	.00000663	.00001193
" dry	.00000363	.00000654
" white Sicilian, dry	.00000786	.00001415
Marble, black Galway	.00000308	.00000554
" Carrara	.00000471	.00000848
Masonry, of brick in cement mortar: headers	.00000494	.00000890
Masonry, of brick in cement mortar: stretchers	.00000256	.00000460
Mercury (cubic expansion)	.00009984	.00017971
Nickel	.00000695	.00001251
Osmium	.00000317	.00000570
Palladium, pure	.00000556	.00001000
Pewter	.00001129	.00002033
Plaster, white	.00000922	.00001660
Platinum	.00000479	.00000863
Platinum, 90 per cent. Iridium, 10 per cent. hammered and annealed	.00000476	.00000857
Platinum, 85 per cent Iridium, 15 per cent	.00000453	.00000815
Porcelain	.00000200	.00000360
Quartz, parallel to major axis, t 0° to 40° C.	.00000434	.00000781
Quartz, perpendicular to major axis, t 0° to 40° C.	.00000788	.00001419
Quartz, cubic expansion at 16° C.	.00001924	.00003463
Silver, pure	.00001079	.00001943
Slate	.00000577	.00001038
Steel, cast	.00000636	.00001144
" tempered	.00000689	.00001240
Stone (sandstone), dry	.00000652	.00001174
Stone (sandstone), Rauville	.00000417	.00000750
Stone (sandstone), Caen	.00000494	.00000890
Tin	.00001163	.00002094
Wedgwood ware	.00000489	.00000881
Wood, pine	.00000276	.00000496
Zinc	.00001407	.00002532
Zinc, 8. Tin, 1.	00001496	.00002692

—Clark's Mechanical Engineer's Pocket Book.

EXPANSION OF LIQUIDS.

The cubical expansion, or expansion of volume, of water, from 32° F. to 212° F. and upwards, is given in the following Table. The rate of expansion increases with the temperature. The expansion for the range of temperature from 32° to 212° is .0466, or fully 4½ per cent. of the volume at 32°; or an average of .000259 per degree, or $\frac{1}{3863}$ part of the volume at 32° F.

Expansion of Liquids from 32° to 212° F.
Volume at 32° = 1.

Liquid.	Volume at 212°.	Expansion.
Alcohol	1.1100	$\frac{1}{9}$
Nitric acid	1.1100	$\frac{1}{9}$
Olive oil	1.0800	$\frac{1}{12}$
Turpentine	1.0700	$\frac{1}{14}$
Sea water	1.0500	$\frac{1}{20}$
Water	1.0466	$\frac{1}{22}$
Mercury	1.018	$\frac{1}{55}$

SMEATON DIVING BELL.

AREA OF CIRCLES IN SQUARE FEET.

Diameter.	TENTHS OF INCHES.									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	AREA—SQUARE FEET.									
Inches.										
1	0.006	0.007	0.008	0.009	0.011	0.012	0.014	0.016	0.018	0.020
2	.022	.024	.026	.029	.031	.034	.037	.040	.043	.046
3	.049	.052	.056	.059	.063	.067	.071	.075	.079	.083
4	.087	.092	.096	.101	.106	.111	.115	.121	.126	.131
5	.136	.142	.147	.153	.159	.165	.171	.177	.184	.190
6	.196	.203	.210	.216	.223	.230	.238	.245	.252	.260
7	.267	.275	.283	.291	.299	.307	.315	.323	.332	.340
8	.349	.358	.367	.376	.385	.394	.403	.413	.422	.432
9	.442	.452	.462	.472	.482	.492	.503	.513	.524	.535
10	.545	.556	.568	.579	.590	.601	.613	.625	.636	.648
11	.660	.672	.684	.697	.709	.721	.734	.747	.760	.772
12	.785	.799	.812	.825	.839	.852	.866	.880	.894	.908
13	.922	.936	.950	.965	.979	.994	1.009	1.024	1.039	1.054
14	1.069	1.084	1.100	1.115	1.131	1.147	1.163	1.179	1.195	1.211
15	1.227	1.244	1.260	1.277	1.294	1.310	1.327	1.344	1.362	1.379
16	1.396	1.414	1.431	1.449	1.467	1.485	1.503	1.521	1.539	1.558
17	1.576	1.595	1.614	1.632	1.651	1.670	1.689	1.709	1.728	1.748
18	1.767	1.787	1.807	1.827	1.847	1.867	1.887	1.907	1.928	1.948
19	1.969	1.990	2.011	2.032	2.053	2.074	2.095	2.117	2.138	2.160
20	2.181	2.204	2.226	2.248	2.270	2.292	2.315	2.337	2.360	2.383
21	2.405	2.428	2.451	2.475	2.498	2.521	2.545	2.568	2.592	2.616
22	2.640	2.664	2.688	2.712	2.737	2.761	2.786	2.810	2.835	2.860
23	2.885	2.910	2.936	2.961	2.986	3.012	3.038	3.064	3.089	3.115
24	3.142	3.168	3.194	3.221	3.247	3.275	3.301	3.328	3.355	3.382

Diameter.	Area.	Diameter.	Area.	Diameter.	Area.	Diameter.	Area.	Diameter.	Area.
Inches.	*Sq. ft.*	*Inches.*	*Sq. ft.*	*Inches.*	*Sq. ft.*	*Inches.*	*Sq. ft.*	*Inches*	*Sq. ft.*
25	3.41	32	5.59	39	8.30	46	11.54	53	15.32
26	3.69	33	5.94	40	8.73	47	12.05	54	15.90
27	3.98	34	6.30	41	9.17	48	12.57	55	16.50
28	4.28	35	6.68	42	9.62	49	13.10	56	17.10
29	4.59	36	7.07	43	10.08	50	13.64	57	17.72
30	4.91	37	7.47	44	10.56	51	14.19	58	18.35
31	5.24	38	7.88	45	11.04	52	14.75	59	18.99

PULLING STRENGTH OF MEN AND ANIMALS.

Compiled from a test made by Barnum & Bailey's Circus.

Number.	Description.	Weight of Each in Lbs.	Total Pull in Lbs.	Pull per Unit.	Pull per Pound of Weight.
2	Horses.	1,600	3,750	1,875	1.172 lbs.
50	Men.	150	8,750	175	1.166 "
100	Men.	150	12,000	120	0.8 "
6	Horses.	1,800	8,875	1,479	0.822 "
2	Camels.	1,800	2,750	1,375	0.764 "
1	Elephant.	12,000	8,750	8,750	0.729 "

THE AMERICAN EXPERIENCE TABLE OF MORTALITY.

Age.	Expectation of Life in Years.	Number Dying in Each 1,000.	Age.	Expectation of Life in Years.	Number Dying in Each 1,000.
20	42.20	7.81	60	14.10	26.69
21	41.53	7.86	61	13.47	28.88
22	40.85	7.91	62	12.86	31.29
23	40.17	7.96	63	12.26	33.94
24	39.49	8.01	64	11.67	36.87
25	38.81	8.07	65	11.10	40.13
26	38.12	8.13	66	10.54	43.71
27	27.43	8.20	67	10.00	47.65
28	36.73	8.26	68	9.47	52.00
29	36.03	8.35	69	8.97	56.76
30	35.33	8.43	70	8.48	61.99
31	34.63	8.51	71	8.00	67.67
32	33.92	8.61	72	7.55	73.73
33	33.21	8.72	73	7.11	80.18
34	32.50	8.83	74	6.68	87.03
35	31.78	8.95	75	6.27	94.37
36	31.07	9.09	76	5.88	102.31
37	30.35	9.23	77	5.49	111.06
38	29.62	9.41	78	5.11	120.83
39	28.90	9.59	79	4.74	131.73
40	28.18	9.79	80	4.39	144 47
41	27.45	10.01	81	4.05	158.61
42	26.72	10.25	82	3.71	174.30
43	26.00	10.52	83	3.39	191.56
44	25.27	10.83	84	3.08	211.36
45	24.54	11.16	85	2.77	235.55
46	23.81	11.56	86	2.47	265.68
47	23.08	12.00	87	2.18	303.02
48	22.36	12.51	88	1.91	346.69
49	21.63	13.11	89	1.66	395.86
50	20.91	13.78	90	1.42	454.55
51	20.20	14.54	91	1.19	532.47
52	19.49	15.39	92	.98	634.26
53	18.79	16.33	93	.80	734.18
54	18.09	17.40	94	.64	857.14
55	17.40	18.57	95	.50	1000.00
56	16.72	19.89			
57	16.05	21.34			
58	15.39	22.94			
59	14.74	24.72			

IMPORTANT INFORMATION ABOUT OLD COINS.

The invention and use of coins is attributed to the Lydians, a Greek nation, about 862 B. C., whose money was of gold and silver. The dating of coins was first adopted about the fifteenth century.

OLD COINS. Coins are not always valuable on account of their age. The old Spanish silver coins which passed current in this country from 1700 to 1800 have no premium value, neither do common dates of cents in ordinary condition of 1798, 1802 and 1803, or old Half Dollars of the common dates between the years 1805 and 1835. In America it is the fashion to make up sets of the different coins comprising each year of their issue, in as fine condition as it is possible to obtain them, and it is the demand for the coin by collectors which makes the value.

THE PRICES paid for rare coins are chiefly regulated by their state of preservation, the number of pieces issued of a certain date, and the demand for same. But neither the metal out of which the coin is made, nor the age, has anything to do with the prices paid.

THE PRICES quoted in this book are the prices paid by a prominent dealer for coins in good to proof condition, hence $5.00 to $10.00 means that they will pay anywhere between those prices, according to the condition of the coin. When applied to a cent, one having the date distinct, hair not worn off, and all the letters legible on both sides; applied to a silver coin means a good bold impression; and to a gold coin one that presents a handsome appearance and does not show signs of wear.

NEVER CLEAN A RARE COIN. A somewhat corroded coin is oftentimes more valuable than a cleaned one. The cleaning of a rare coin considerably decreases its value.

CLASSIFICATION OF THE CONDITION OF COINS.

THE STATE OF PRESERVATION OF COINS IS CLASSIFIED AS FOLLOWS:

"PROOF."

Proof coins are especially struck for collectors from polished blanks and dies and finished by hand, which gives them a mirror-like, smooth, reflective surface. The most perfect condition known. The mint makes a small charge for the proof coins, and they can only be had during the year of the issue.

"UNCIRCULATED."

Uncirculated coins are coins struck for circulation. But coins, to be classified as "uncirculated" must be as new and bright as when dropped from the coinage press; a coin that has been in circulation, no matter whether it shows no marks of wear, cannot be classified as uncirculated.

"FINE."

Fine coins are those that have been in circulation and have lost their original mint brightness, but they must not show any scratches or nicks.

"GOOD."

Good coins are those which have seen considerable circulation, but every feature of the coin must show plainly. It must not show any bad scratches or nicks.

"FAIR."

Fair coins are those which are much worn, but on which the design, lettering and date are clearly visible.

"POOR."

Poor coins are those on which the design, lettering and date are almost obliterated. Poor coins, unless of a very rare date, are worth their intrinsic value only.

MUTILATED COINS.

Mutilated coins are those with holes, bad cuts or scratches, or otherwise damaged and are worth their intrinsic value only.

"OVER-DATES."

When a die, made in one year, is used in a later year, by engraving one figure over another, the piece struck therefrom is called an "over-date." For instance, the same die from which the Cents of 1810 were struck was used in 1811, by sinking a 1 over the 0, and portions of the latter figure are plainly visible.

COUNTERFEIT RARE COINS.

COUNTERFEITS OF RARE COINS MAY BE DIVIDED AS FOLLOWS:

"RE-STRIKES."

Re-strikes are pieces made from the original dies, but at a later period than the date on the coin. Among the American coins we find re-strikes of the dollar of 1804, and of the half cents of 1831, 1836 and 1840 to 1849. The re-strikes, of course, do not command near the price of the originals. At present the dies are destroyed after the expiration of each year.

"ALTERED-DATES."

Altered dates are original coins which have been altered or tooled from one date to another, and these may justly be classed as forgeries. The rarer dates of the American coins are at times tampered with; especially the dollars of 1801, which are altered to the 1804. But an altered date can easily be detected by the aid of a good magnifying glass.

"ELECTROTYPES."

The front and back of electrotype coins are made separate and are then stuck together, and they may be easily recognized by the mark on edge showing where the two sides have been joined together. They are also of wrong weight. The electrotypes, as a rule, are not made to deceive the uninitiated, but are simply made as copies of very rare coins, where the two sides have been joined together chased. Electrotypes may generally be split in two with a strong knife.

"CAST COINS."

Casts, made from the original dies, are easily detected by their light weight or thickness. The lettering on cast coins is not as sharp as on struck coins, and the surface has a soft appearance, or else is covered with minute sand holes.

Forgeries struck from false dies are mostly found of the rarer Colonial and U. S. Pieces, also of rare ancient gold and silver coins. They are easily detected by anyone somewhat familiar with rare coins, as the weight of the forgeries is mostly incorrect, and the lettering and design are sharper than on the genuine.

Fine and Perfect U. S. Cents. There are here and there to be found cents of the early dates which have been laid away carefully since the time they were coined. These are sometimes valuable. For instance, for a cent of 1799 in good condition one can get $5; but for a fine cent of the same date, from $15 to $30; and for a perfect cent of 1799, that is as bright and sharp as the day it was coined, $50.

Cleaning. Do not attempt to clean fine coins; they should be handled only on the edge, and kept wrapped carefully in chamois skin or soft tissue paper, or laid on velvet. Gold and silver coins may be rinsed, not washed, in hot water and soap. Copper coins should be placed in sweet oil only to remove grease and dirt; acid and scouring will ruin any coin of value.

"EXPLANATIONS."

THE TERMS USED TO DEFINE THE VARIOUS PARTS OF A COIN.

The principal object represented on a coin is called the Type.

The space between the type and the circumference is called the Field.

The lower portion of the area of a coin beneath the type, and separated from the rest of the field by a horizontal line, is called the Exergue.

Small objects represented either in the field or exergue as adjuncts to the main type are called Symbols.

Portions of a coin which are sunk below the level of the surface are said to be Incuse.

Obverse means the head or face of the coin, or the side having the principal device.

Reverse means the tail, or less important side.

Legend means the reading on the coin.

Flowing Hair denotes the hair flowing loosely at the back of the head.

Liberty Cap denotes a bust supporting a pole on which is mounted a cap of Liberty.

Fillet Head denotes the hair tied in a knot at the back of the head.

Turban Head denotes a head surmounted by a turban inscribed "Liberty."

Dies. A thick die usually has lettering on the edge of the coin; a thin die has none.

First Regular Coinage denotes the first year a coin was issued for circulation. Patterns are coins struck off but not into circulation.

Mint Marks consist of small letters on the coin. O., for New Orleans; D., for Dahlonega; C. C., for Carson City; S., for San Francisco, while those coined at the Philadelphia mint have none.

Arrows and Rays. In the early part of the year 1858, arrow points were added at each side of the date, and rays around the eagle.

Milled Edge. In the early part of 1836 the Half Dollars were coined with lettered edge, and in the latter part with milled or ribbed edge, as they are to-day.

THE MOTTO ON U. S. COINS.

"In God We Trust."

Since the new 1907 issues of $10.00 and $20.00 gold pieces appeared, many are of the belief that all U. S. coins without the motto command a premium. This is not true. The motto was not placed on coins till 1864; the two-cent piece being the first coin bearing the motto. So, of course, all U. S. coins prior to 1864 are without the motto.

WEIGHTS AND FINENESS OF COINS.

A gold dollar weighs 25.8 grains 9/10 pure gold, or 23.22 grains.

An ounce of gold 1000 fine is worth $20.671834+.

An ounce of silver 1000 fine is worth (coinage value) $1.292929+.

All American gold and silver coins are 9/10, or .900 fine.

A pound sterling weighs 123.274+ grains, 11/12 pure gold, or 113.0016+ grains.

A pound sterling is worth $4.8665635287+.

An ounce of silver, English standard, is .925 fine=444 grains pure silver.

An ounce of silver, American standard, is .969 fine=432 grains pure silver.

An ounce of silver, "fine" standard, is 1.000 fine=480 grains pure silver.

A United States silver dollar weighs 412½ grains .900 fine; contains 371.25 grains pure silver.

A dollar of fractional silver weighs 25 grains =385.80 grains, .900 fine; contains 347.22 grains pure silver.

An English shilling weighs 87.273 grains, .900 fine; contains 80.729 grains pure silver.

The pure gold in gold coins of the United States is worth the face value of the coin.

The alloy in gold coins of the United States is pure silver and copper.

The alloy in silver coins of the United States is pure copper.

U. S. MINT TEST FOR GOLD AND SILVER,

The following is a test for determining whether a coin is good or bad. Use the liquids as near the edge of the coin as possible, as that is the part most worn. A drop of the preparation will have no effect on a genuine coin, while it can be plainly seen on counterfeits. Heavily plated coins should be scraped slightly before testing.

TEST FOR GOLD.

Strong Nitric Acid, 6½ drachms.
Mur. Acid, ¼ drachm, or 15 drops.
Water, 5 drachms.

TEST FOR SILVER.

24 Grains of Nitrate of Silver.
30 Drops Nitric Acid.
Water, 1 ounce.

The above test should conform with diameter, thickness and weight, the test used at the mint.

PREMIUM COIN LIST.

$20.00 GOLD PIECES.

DOUBLE EAGLES.

Coinage commenced in 1849; only one specimen of this date is known.

1881, $20.50 to $21.00—1882, $21.00 to $22.50—1883, $22.00 to $25.00—1884, $21.00 to $25.00—1885, $20.50 to $21.00—1886, $20.50 to $21.00—1887, $21.00 to $22.50—1891, $20.50 to $21.00—1907, Flying eagle, the date in Roman letters —$21.00 to $22.50—Flying eagle, the date in numerals, $20.50—1908, Flying Eagle, commands no premium.

The other dates of the $20.00 gold pieces command no premium.

$10.00 GOLD PIECES.

EAGLES.

Coinage commenced in 1795. None issued in 1802, 1805 to 1837 inclusive. Coined at the Philadelphia, New Orleans, San Francisco, Carson City and Denver mints.

1795, $11.00 to $13.00—1796, $12.00 to $15.00 —1797, small eagle, $15.00 to $20.00—1797, large eagle, $11.00 to $12.00—1798, six stars before Liberty head, $13.00 to $18.00—1798, four stars before Liberty head, $13.00 to $20.00—1799 to 1803, $11.00 to $12.00—1804, $12.00 to $15.00—1838, $10.50 to $12.50—1863 to 1877, $10.25 to $11.00. 1907, without the motto, commands no premium.

$5.00 GOLD PIECES.

Coinage commenced in 1795. None were coined in 1801, 1816 and 1817. Coined at the Philadelphia, New Orleans, San Francisco, Charlotte, N. C., Dahlonega, Ga., Carson City and Denver mints.

1795, Small eagle, $6.50 to $7.50—1795, Large eagle, $10.00 to $20.00—1796, $7.00 to $10.00—1797, small eagle, 15 stars, $10.00 to $18.00—1797, large eagle, 16 stars, $10.00 to $22.00—1798, 1799, 1800, $5.50 to $6.50—1798, small eagle, $20.00 to $30.00—1802 to 1814, turban head, left, $5.25 to $5.75—1815, $75.00 to $100.00—1818, $5.50 to $6.50—1819 and 1832, $8.00 to $18.00—1820, $7.00 to $9.00—1821, $10.00 to $15.00—1822, $75.00 to $100.00—1823, $8.00 to $10.00—1824, $15.00 to $20.00—1825, 1826, 1827, 1830, 1831, 1833, $8.00 to $13.00—1828, $15.00 to $25.00—1829, $15.00 to $25.00—1834, with "E Pluribus Unum" over eagle, $7.50 to $10.00—1834, without "E Pluribus Unum," no premium—1875, $7.50 to $9.00—1876, $5.50 to $6.00—1877, $5.50 to $6.00—1877, $10.00 to $13.00. The dates of $5.00 gold pieces not mentioned in this list do not command a premium.

$4.00—STELLA.

1879, $20.00—1880, $35.00.

$3.00.

1864-65, Indian Head, $4.00 to $5.00—1873, $10.00 to $15.00—1875, $15.00 to $20.00—1876, $5.00 to $10.00—1877, $5.00 to $8.00. $3.50 to $4.00 is paid for $3.00 gold pieces of any date, if in perfect condition. First regular issue, 1854; last, 1889.

$2.50—QUARTER EAGLE.

1796, without stars, $7.50 to $10.00—1796, with stars, $9.00 to $15.00—1797, $9.00 to $15.00—1798, $6.00 to $10.00—1802-4-5-7-8, $3.00 to $5.00—1806, $7.00 to $15.00—1821-24-25-27, $5.00 to $8.00—1826, $10.00 to $30.00—1829-30-31-32-33, $3.00 to $5.00—1834, with "E Pluribus Unum," $4.00 to $6.00. First regular coinage, 1796; none coined 1799, 1800, '01, '03, '09 to '20, '22, '23, '28 bearing little or no premium, 1835 to date.

ONE DOLLAR.

1863, '64 and '65, Indian head, $4.00 to $6.00 —1866, Indian head, $2.50 to $4.00—1875, Indian head, $10.00 to $12.00. Any other dates

from 1849 to date, $2.00 to $3.00. First regular issue, 1849; last, 1889; 1903, Louisiana Purchase. St. Louis gold dollars, $1.75.

U. S. SILVER COINS,

ONE DOLLAR.

The rarest and most desirable coin of the regular mint series is the Silver Dollar of 1804. Of this coin, however, it is necessary that the authenticity should be fully proven, as there are many altered dated in the market, as well as re-strikes made at a later period. 1794, flowing hair, small eagle, $25.00 to $50.00—1795, flowing hair, small eagle, $1.50 to $2.00—1795, '96, Fillet head, small eagle, $1.50 to $2.00—1797, fillet head, small eagle, $1.50 to $2.00—1798, fillet head, 13 stars, small eagle, $2.00 to $2.50—1798, fillet head, 15 stars, small eagle, $2.00 to $3.50—1798, fillet head, 13 stars, large eagle, $1.25 to $1.75—1799, fillet head, 5 stars facing eagle, $1.50 to $2.00—1799, fillet head, 6 stars, $1.25 to $1.75—1800, fillet head, large eagle, $1.25 to $1.75—1801, fillet head, large eagle, $1.25 to $2.00—1802, 1803, $1.25 to $1.50—1804, no originals known—1836, Liberty seated, flying eagle, 8 stars, $4.00 to $7.00—1836, C. Gobrecht's name in field, $15.00 to $25.00—1838, Liberty seated, flying eagle, stars, $25.00 to $40.00—1839, Liberty seated, flying eagle, stars, $25.00 to $35.00—1840, Liberty seated, eagle, $1.15—1851, 1852, $20.00 to $30.00—1854, $2.00 to $3.00—1855, $1.50 to $1.75—1856, 1857, $1.25 to $1.50—1858, $10.00 to $15.00—1900, Lafayette dollar, perfect only, $1.10. First regular coinage, 1794; none coined 1805 to 1835; 1874 to 1877; little or no premium on dates not mentioned except on proofs only, 70c.

TRADE DOLLARS.

Proofs only, 75c. Coinage commenced in 1873; repudiated in 1884. Redeemed in 1887.

HALF DOLLARS.

1794, flowing hair, $2.50 to $4.00—1795, $.60 to $1.00—1796, fillet head, 15 stars, $15.00 to $30.00—1796, 16 stars, $20.00 to $35.00—1797, $20.00 to $35.00—1801, 1802, $2.00 to $3.00—1803, 1805, 55c to 60c—1815, head to left, $1.50 to $2.50—1836, milled edge, not lettered, $1.00 to $2.00—1838, having a small o under the bust and over the date—$25.00 to $50.00—1852, Liberty seated, $1.00 to $2.00—1853, without arrowheads each side of date, or rays back of eagle—$25.00 to $30.00. First regular coinage, 1794; none coined 1798, '99, 1800, 1804, '16, otherwise to date little or no premium on dates not mentioned. 1892, Columbia Half—no premium.

QUARTER DOLLARS.

1796, 1804, fillet head, $1.00 to $2.00—1815, 35c to 50c—1822, head to left, $20.00 to $40.00—1824, head to left, 50c to 75c—1827, head to left, $30.00 to $50.00—1853, no arrow points at each side of date and no rays around eagle, $3.00 to $4.00—Columbia Isabella, 30c to 40c. First regular coinage, 1796; none coined 1797 to 1803, 1808 to '14, 1817 and '26; otherwise to date little or no premium on dates not mentioned.

TWENTY CENT PIECES.

1877 and 1878, each, $1.50. First Regular coinage, 1875; last, 1878; there is no premium on 1875 and 1876.

DIMES.

1796, fillet head, small eagle, $1.00 to $2.00—1797, fillet head, 13 and 16 stars, $2.00 to $4.00—1798, fillet head, large eagle, $1.50 to $2.00—1800 and 1802, large eagle, $1.50 to $2.50—1801 and 1803, large eagle, $1.00 and $2.00—1804, large eagle, $4.00 to $10.00—1805 and 1807, large eagle, 25c to 50c—1809 and 1811, turban head, 25c to 50c—1822, turban head, 50c to $1.50—1846, Liberty seated, 25c to 75c. First regular coinage, 1796; none coined in 1799, 1806, '08, '10, '12, '13, '15 to '19 and '26; otherwise to date little or no premium on dates not mentioned.

HALF DIMES—5 CENTS.

1794, flowing hair, $1.00 to $2.00—1795, flowing hair, 50c to $1.00—1796, fillet head, $1.50 to $3.00—1797, fillet head, 13 stars, $1.00 to $2.00—1797, fillet head, 15 and 16 stars, $1.00 to $2.00—1800, fillet head, 50c to $1.00—1801, fillet head, 75c to $1.00—1802, fillet head, $20.00 to $40.00—1803, fillet head, $1.00 to $2.00—1805, fillet head, $2.00 to $3.00—1846, Liberty seated, 75c to $1.00. First regular coinage, 1794; last, 1873; none coined 1798, '99, 1804, '06, to '28; little or no premium on dates not mentioned.

SILVER 3 CENT PIECES.

1863 to 1869, each, 25c to 75c—1870 to 1872, each, 15c to 40c—1873, coinage discontinued, 50c to 75c.

NICKEL 5 CENT PIECES.

1877, $1.00 to $2.00—1878, 10c to 20c—1883, without the word "Cents" does not command a premium.

NICKEL 3 CENT PIECES.

1865 to 1876, proofs only, 5c—1877, 50c to $1.00—1878 to 1889, proofs only, 5c to 10c.

NICKEL CENTS.

1856, flying eagle, $3.00 to $5.00. Nickel cents were coined from 1856 to 1864; from '56 to '58 design was a flying eagle; from '59 to '64 an Indian head; all except 1856 bear no premium.

HALF CENTS.

1793, Liberty, $1.00 to $3.00—1794 and 1795, Liberty cap, 25c to 50c—1796, Liberty cap, $10.00 to $25.00—1795 and 1797, Liberty cap, lettered edge, 25c to $1.00—1797, Liberty cap, thin die, 25c to 50c—1800 fillet head, 5c to 30c—1802, fillet head, 75c to $1.00—1803 to 1809, fillet head, 5c to 15c—1810, turban head, 5c to 15c—1811, turban head, 25c to 75c—1831, 1836, 1840 to 1848, each, $3.00 to $12.00—1849, small date, and 1852, $3.00 to $10.00. All other dates command a small premium.

BRONZE 2 CENTS.

1872, 3c to 15c—1873, 20c to $1.00.

U. S. COPPER CENTS.

1793, flowing hair, chain Ameri, $2.50 to $10.00—1793, flowing hair chain Ameri, $1.50 to $7.00—1793, flowing hair, wreath, $1.50 to $3.50—1793, flowing hair, clover leaf, $2.50 to $10.00—1794, liberty cap, 25c to $1.00—1795, liberty cap lettered edge, 50c to $1.00—1795, liberty cap thin die, 25c to $1.00—1796, liberty cap, 25c to $1.50—1796, fillet head, 25c to $1.50—1797, fillet head, 20c to $1.50—1798, fillet head, 10c to $1.00—1799, fillet head, $5.00 to $30.00—1800, 1801, 1802, 1803, 1807, 5c to 50c—1804, fillet head, $3.00 to $15.00—1805 to 1806, 10c to 75c—1808, turban head to left 12 stars, 15c to $1.00—1808, 13 stars, 10c to 75c—1809, 20c to $2.00—1810-1812, 5c to 25c—1811, 25c to $2.00—1813, 10c to 50c—1814, 13 stars, 2c to 25c—1821, 15 stars, head of Liberty, 3c to 50c—1823, 10c to 75c—1857, 5c to 25c.

SILVER.

(1652) XII. Pence, $20.00—VI. Pence, $20.00—III., but two specimens known, $75.00. The above were coined about the year 1652 (no date on the coin), for New England. The obverse has N. E., and the reverse either XII. or VI. or III. at the top of the coin; otherwise, it is perfectly plain. New England comprised New Hampshire, Massachusetts, Rhode Island and Connecticut.

PINE TREE COINS.

1652, III. Pence, $1.50 to $2.50—1652, VI. Pence, $2.00 to $3.00—1652, XII. Pence (shilling), $3.00 to $6.00.

OAK TREE.

1652, II. Pence, $1.00 to $2.00—1652, III. Pence, $1.50 to $3.00—1652, VI. Pence, $2.00 to $3.00—1652, XII. Pence (shilling), $3.00 to $5.00. These coins come with the dates 1650-1652 and 1662, but were coined for several years without changing the date. Some of them had an oak or willow tree, and they are frequently clipped, and an early series of counterfeits by one Wyatt are plentiful, having fine lines across. The obverse have: A pine or oak tree in centre; the legend: "Masathvsets." The reverse: XII. and date; with legend: "New England. An dom."

SOMMER ISLANDS.

BRASS.

First coin made for America, in memory of Sir George Sommers, who was shipwrecked upon the Bermudas or Sommer Islands in 1612. They are made of copper—shilling, sixpence and threepence. They bear no date, but are supposed to have been coined in 1616. Shilling—ship sailing, running boar, $20.00 to $40.00. Sixpence—ship sailing, running boar, $15.00 to $35.00. Threepence—ship sailing, running boar, $15.00 to $35.00.

LOUISIANA AND CANADA.

SILVER.

1670, Crown, $25.00—1670, half franc, $4.00. These were coined in France for use in their colonies in America, and have on the obverse: "Lud XIIII. D G Fr et Nav Rex;" reverse; "Gloriam Regni Tui Dicent, 1670."

COPPER.

1670, Double L Crowned, $5.00—1721, Two L's crossed, 50c—1722, Two L's crossed, 50c—1767, Two Scepters crossed, 40c.

CAROLINA AND NEW ENGLAND.

COPPER.

1694, Carolina, $20.00—1694, New England, $40.00. The above were coined in England for the colonies. The obverse has an Elephant; the reverse: God preserve New England (or Carolina) and its Lords Proprietors, 1864.

MARYLAND.

SILVER.

XII Pence, Lord Baltimore (1659), $10.00—VI Pence, Lord Baltimore, $10.00—III Pence, Lord Baltimore, $10.00. Obverse: Bust; legend: Coecilivus Dus Terrae, Mariae & Ct. Reverse, a crowned shield. XII Crescite et Mvltiplicamini. No date on coin. Coined in England for and circulated in Maryland about 1659.

1790, III Pence, Standish Barry, $10.00—1783, Shilling, Annapolis, $3.00—1783, Sixpence. Annapolis, $3.00—1783, Three pence, Annapolis, $3.00.

ROSA AMERICANA.

COPPER.

1722, Penny, uncrowned rose, $1.00—1722, ¼ Penny uncrowned rose, 25c—1722, Farthing, uncrowned rose, 50c—½ Penny, no date, uncrowned rose, $10.00—Penny, no date, uncrowned rose, $10.00—1723, Penny, crowned rose, $1.50—1723, ½ Penny, crowned rose, 50c—1723, Farthing, crowned rose, 50c—1724, ½ Penny, crowned rose, $10.00—1733, Penny (twopence size), $20.00. The above bears on the obverse a bust; legend: Georgius: D: G: Mag: Bri: Fra: et: Hib: Rex. Reverse: a rose, either crowned or uncrowned; legend: Rosa Americana and date. Some will be found without date. Of English origin and coined for the American colonies.

CONNECTICUT.

COPPER.

1737, Threepence, Connecticut, $25.00—1737, Threepence, I am Good Copper, $25.00. Of the above there are two varieties; one bears the date and the other does not, but both were coined about the same period. The obverse has: A Deer in standing position: Legend: "The Value of Threepence," or "Value me as you please." The reverse: Three crowned hammers: I am good copper 1737 or an Ax. I cut my way through. Circulated in the colonies.

1785, Cent. Auctori Connec, 10c—1786, Cent. Auctori Connec, 10c—1787, Cent. Auctori Connec, 5c—1788, Cent. Auctori Connec, 10c. The obverse of these four bear a bust, either facing right or left: Legend: Auctori Connec or Connect. The reverse Liberty seated "Inde et Lib." (Independence and Liberty.) Coined and circulated in the Colonies after their independence.

FLORIDA.

SILVER.

1760, Half Dollar, $10.00. This has the head of Charles III of Spain on the obverse, and on the reverse a rose.

PITT HALF PENNY.

COPPER.

1766, no stamps, 50c.

VIRGINIA.

1773, Half Dollar, silver, $2.00—1773, Half Penny, copper, 15c—1774, Shilling, silver, $12.00. Obverse, Bust of George III, Coat of Arms 1773, Virginia.

CONTINENTAL COINS.

PEWTER.

1776, Dollar, $3.00. The obverse: Sun blazing on a sun dial; legend: Fugio, Mind your business, Continental Currency and date. Reverse, chain of 13 links; each link has the name of one of the original states upon it; legend: America Congress, We Are One.

NEW YORK.

GOLD.

1787, Doubloon, Nova Eboraca, $100.00. Obverse: Rising sun; legend: Nova Eboraca, Columbia. Reverse: Spread eagle, Unum E Pluribus, 1787.

COPPER.

1786, Non vi virtue vici, $25.00. The obverse has a bust facing to left; legend: Non Vi Virtue Vici. The reverse: Justice seated. Neo Eboracensis and date, 1787, Excelsior $10.00. The obverse has: An Eagle, E Pluribus Unum and date. The reverse: The Coat of Arms of

New York, Excelsior—1787, George Clinton, $50.00. Obverse: Bust Geo. Clinton. Reverse: Arms of New York, date and Excelsior—1787, Nova Eborac, 50c. Obverse: Bust, "Nova Eborac." Reverse: Liberty seated, "Virt et Lib," and date—1778, Non Dependens Status, $10.00—1787, Inimica Tyrannis, $10.00—1787, Neo Eboracus, $15.00—1787, Emunis Columbia, $2.00.

GEORGIA.

COPPER.

1783 Georgius Triumpho, 30c.

VERMONT.

COPPER.

1785, Doubloon, Immune Columbia, $200.00.

SILVER.

1783, Half Dollar U. S. 1000, $100.00—Quarter Dollar, 900, $50.00—1783, Shilling 250, $50.00.

COPPER CENTS.

1783-85, Nova Constallatio, 15c—1786, Nova Constallatio, $5.00. Obverse: An eye; legend: Nova Constellatio. Reverse: U. S. Liberties et Justitia, with date—1785, Immune Columbia, $5.00. Obverse: a bust or an eye; legend: Vermontis Republica and date. Reverse: Justice, seated, Immune Columbia—1785, Vermont Republica, 50c—1786, Vermontensium Republica, 50c. Obverse: An eye, legend: Vermonts Res Publica. Reverse: a hill with trees; legend: Steela Quarta Decima, and date—1786-87-88, Vernon Auctori, 15c. A bust, Vermon Auctori. Reverse: Liberty seated, inde et lib., and date.

KENTUCKY.

SILVER.

1796, Myddleton token, $10.00. The obverse: A group; legend: British Settlements in Kentucky and date. Reverse: Britannia seated on a globe; legend: "Payable by P. P. Mydleton. Coined in England for the colonies.

COPPER.

1796, same in copper, $10.00—1796, same in copper ½ penny, $10.00 (1785), Copper, $1.00. The above have on the obverse fifteen stars forming a triangle. Each star contains a letter, being the initial letters of each State of the Union; legend: E Pluribus Unum. Reverse: A hand holding a scroll. "Unanimity is the strength of society." Coined about 1785 in England, and circulated in the colony. No date.

MASSACHUSETTS.

CENTS AND HALF CENTS.

1776, Half Penny, three heads, $5.00 to $10.00—1787, Half Cent, Indian, Eagle, 25c to 50c—1788, Half Cent, Indian, Eagle, 25c to 75c—1787, One Cent, Indian, Eagle, 10c to 25c—1788, One Cent, Indian, Eagle, 10c to 25c—1787, One Cent, Arrows in left claw $5.00 to $7.00. The obverse: An Indian; legend: Commonwealth. Reverse: An eagle, upon its breast the value of the coin; above its head, Massachusetts; below, the date; olive branch and bunch of arrows in its claws—1788, Cent, $10.00, same but arrows in eagle's right claw.

NEW HAMPSHIRE CENT.

1776, Cedar Tree, American Liberty, $3.00 to $5.00.

NEW JERSEY.

1786, '87, '88, 5c. The obverse: A horse head over a plow; legend: Nova Caesarea and date. Reverse: a shield, E Pluribus Unum—1788, horse head to left, 50c—1786, $10.00.

Same as above but with the date above the beam of the plow, while in the above it appears below the plow. 1786, Justice, Immunis Columbia, $10.00.

UNITED STATES COINS.

1787, Silver, $5.00—1787, Copper cent, 10c. The obverse: Sun blazing upon a sun dial. Fugio and date, "Mind your business." Reverse: A chain of 13 links; in centre: "We are one—United States." The above was the first coin legally authorized by act of Congress of the United States. It is called the Franklin Cent, on account of the legend, "Mind your Business." U. S. A. Bar cent, 50c—1792, Liberty, Parent of Science, $10.00.

WASHINGTON PIECES.

SILVER.

1792, 15 stars, $30.00—1792, no stars, $30.00. Obverse: Bust of G. W.; legend: G. Washington, President, 1792. Reverse: Eagle, stars and no stars, United States of America—1792, Dime, $15.00—1792, Half Dime, $5.00. Obverse: A head (representing Martha Washington); legend: Liberty, Parent of Science and Industry, 1792. Reverse: Eagle, United States of America.

COPPER.

1783, United States (brass), 15c—1783, United States, 15c. Obverse, Bust of Washington; legend: Washington and Independence and date. Reverse: United States and also Unity States. No date, double head, 15c—1791, small eagle cent, 8 stars, $3.00—1792, small eagle, 6 stars, $20.00—1791, large eagle, no stars, $2.00—1792, eagle 13 and 15 stars, $15.00. Bust G. W. legend: Washington, President, and date. Reverse: An eagle holding a scroll in its beak—1791-93, Ship Half Penny, $1.00—1791-93, Ship, Liverpool Penny, $3.00—1795, Grate Cent, 50c—1795, Liberty and Security, 50c. Nearly all the Washington pieces, especially the Cents and Half Dollars, were coined in England as patterns for the American coinage, but the designs were not accepted, as it was considered contrary to the principles of our government to stamp the head of our President upon the National coinage.

CALIFORNIA GOLD AND PRIVATE ISSUES.

$50.00 GOLD PIECES.

1851, Augustus Humbert, octagon, $75.00 to $100.00.

The California gold issues are of considerable interest, including as they do $50 gold pieces, oblong gold pieces of approximately the value of $40, $25 pieces, $16 oblong pieces, $10 pieces, $9.43 oblong pieces, $5 pieces, $2.50 pieces, $1 round and $1 octagon, half dollars round, half dollars octagonal, quarter dollars round, quarter dollars octagonal. The value of these coins varies from 75c to $100. The amount of bullion contained in the coin having a considerable bearing. Carolina and Georgia gold, also Colorado and Oregon gold pieces command considerable premium. There are also gold pieces from Utah and Mormon gold pieces. The whole subject is taken up in detail in Lehrenkrauss's pocket manual and premium coin list, which can be obtained from the publishers at Brooklyn, N. Y. In the same booklet the prices are given of the issues of paper currency. Also, the value of foreign money, both coins and bank notes. The book is sold at the merely nominal price of ten cents, and the Editor acknowledges his indebtedness.

Weights of the U. S. Coins

And the Amounts for Which They are Legal Tender.

GOLD.

Denominations	Weight, Grains	Amount for which a legal tender
Double Eagle, $20	516.	Gold coins of denomination are legal tenders for any amount.
Eagle, $10	258.	
Half Eagle, $5	129.	
Three Dollars	77.4	
Quarter Eagle, $2.50	64.5	
Dollars	25.8	

SILVER.

Denominations	Weight, Grains	Amount for which a legal tender
Standard Dollar	412.5	Unlimited.
Trade Dollar	420.	Demonetized—Not a legal tender
Half Dollars	192.9	Ten dollars.
Quarter Dollars	96.45	Ten dollars.
Twenty-Cent Pieces	77.16	Five dollars.
Dimes	38.58	Ten dollars.
Half-Dimes	19.29	Five dollars.
Three-Cent Pieces	11.52	Five dollars.

MINOR COINS.

Denominations	Weight, Grains	Amount for which a legal tender
Five Cents	77.6	Twenty-five cents.
Three Cents	30.	Twenty-five cents.
Two Cents	96.	Twenty-five cents.
Cents	48.	Twenty-five cents.

Wedding Anniversaries.

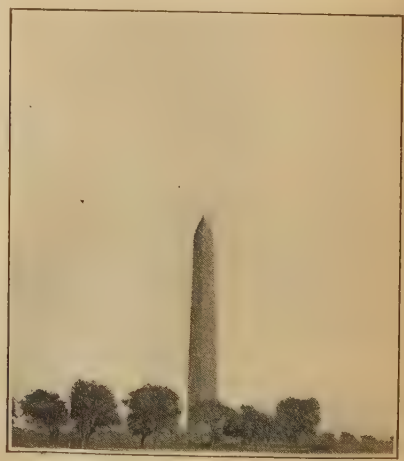
1st	year	Paper
2d	"	Calico
3d	"	Muslin
4th	"	Silk
5th	"	Wood
6th	"	Iron
7th	"	Copper
8th	"	Bronze
9th	"	Pottery
10th	"	Tin
15th	"	Rock-crystal
20th	"	China
25th	"	Silver
30th	"	Pearl
35th	"	Coral
40th	"	Ruby
45th	"	Sapphire
50th	"	Gold
55th	"	Emerald
60th	"	Diamond
75th	"	Diamond

Birth Stones.

Month.	Stone
January	Garnet
February	Amethyst, Hyacinth, Pearl
March	Jasper, Bloodstone
April	Diamond, Sapphire
May	Emerald, Agate
June	Cat's-eye, Turquoise, Agate
July	Turquoise, Onyx
August	Sardonyx, Carnelian, Moonstone, Topaz
September	Chrysolite
October	Beryl, Opal
November	Topaz, Pearl
December	Ruby, Bloodstone

Courtesy of Tiffany & Co.

THE EIFFEL TOWER.



WASHINGTON MONUMENT.

Photographed to scale: 1 inch=500 feet.

THE "STEEL AGE" AND THE "STONE AGE."

STATE HOLIDAYS, NICKNAMES AND FLOWERS.*

STATE OF ALABAMA.

January 1, New Year's Day; January 19, Robert E. Lee's Birthday; February 22, Washington's Birthday; April 13, Thomas Jefferson's Birthday; April 26, Memorial Day; June 3, Jefferson Davis' Birthday; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; last Thursday in November, Thanksgiving Day; December 25, Christmas Day; Tuesday before Ash Wednesday, "Mardi Gras Day."

State Nickname: "Cotton State."

State Flower: Goldenrod.

STATE OF ARIZONA.

January 1, New Year's Day; February 14, Admission Day; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; last Thursday in November, Thanksgiving Day; December 25, Christmas Day; every Saturday after 12 o'clock for State and county officers during June, July and August; every day on which an election is held throughout the State; every day appointed by the President of the United States, or the Governor of the State, as a public fast, thanksgiving, or holiday.

State Flower: Sequoia Cactus.

STATE OF ARKANSAS.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Bear State."

State Flower: Apple Blossom.

STATE OF CALIFORNIA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; September 9, Admission Day; October 12, Columbus Day; December 25, Christmas Day; every day on which an election is held throughout the State; every day appointed by the President of the United States, or by the Governor of the State, for a public fast, thanksgiving, or holiday. Every Saturday from 12 o'clock noon until 12 o'clock midnight is a holiday as regards the transaction of business in the public offices of the State.

State Nickname: "Golden State."

State Flower: Golden Poppy.

STATE OF COLORADO.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Decoration Day; July 4, Independence Day; August 1, Colorado Day; 1st Monday in September, Labor Day; October 12, Columbus Day; (one) day in November, Election Day; December 25, Christmas Day.

State Nickname: "Centennial State."

State Flower: Columbine.

DISTRICT OF COLUMBIA.

January 1, New Year's Day; February 22, Washington's Birthday; March 4, Inauguration Day, every fourth year; May 30, Memorial Day; July 4, Independence Day; the first Monday in September, Labor Day; Thanksgiving Day; December 25, Christmas Day.

STATE OF CONNECTICUT.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday of September, Labor Day; October 12, Columbus Day; December 25, Christmas Day; the day designated by the Governor as a day of fasting and prayer, customarily Good Friday; the day designated by the Governor as a day of Thanksgiving, customarily the last Thursday of November.

State Nickname: "Nutmeg State."

State Flower: Mountain Laurel.

STATE OF DELAWARE

January 1, New Year's Day; February 12, Lincoln's Birthday; third Tuesday of February, Election Day; February 22, Washington's Birthday; Good Friday; May 30, Memorial Day; July 4, Independence Day; first Monday of September, Labor Day; the first Tuesday after the first Monday of November, Election Day; December 25, Christmas Day; every Saturday after 12 o'clock noon until 12 o'clock midnight; any day appointed or recommended by the Governor of the State or the President of the United States as a day of thanksgiving or fasting and prayer, or other religious observance.

State Nickname: "Blue Hen State."

State Flower: Peach Blossom.

STATE OF FLORIDA.

January 1, New Year's Day; January 19, Robert E. Lee's Birthday; February 22, Washington's Birthday; April 26, Memorial Day; June 3, Jefferson Davis' Birthday; July 4, Independence Day; first Monday in September, Labor Day; General Election Day; Thanksgiving Day; December 25, Christmas Day; in cities or towns where carnival associations are organized for the purpose of celebrating the same, the day in each year known as Shrove Tuesday.

State Nickname: "Peninsular State."

State Flower: Orange Blossom.

STATE OF GEORGIA.

January 1, New Year's Day; February 12, Georgia Day; February 22, Washington's Birthday; April 26, Confederate Memorial Day; June 3, Jefferson Davis' Birthday; July 4, Independence Day; 1st Monday in September, Labor Day; last Thursday in November, Thanksgiving Day; December 25, Christmas Day; every day on which an election is held throughout the State; every day appointed by the President of the United States or the Governor of the State, as a public fast or Thanksgiving day, or holiday.

State Nickname: "Cracker State."

State Flower: Cherokee Rose.

STATE OF IDAHO.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Decoration Day; June 15, Idaho Pioneer Day; July 4, Independence Day; first Monday in September, Labor Day; October 12, Columbus Day; December 25, Christmas Day; every day on which an election is held throughout the State, and every day appointed by the President of the United States or by the Governor of the State, for a public fast, thanksgiving, or holiday.

State Flower: Syringa.

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STATE OF ILLINOIS.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; Thanksgiving Day; December 25, Christmas Day; in cities of 200,000 inhabitants or more, from 12 o'clock noon to 12 o'clock midnight on Saturday.

State Nickname: "Sucker State."
State Flower: Violet.

STATE OF INDIANA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; Labor Day; Thanksgiving Day; December 25, Christmas Day; the day of any General National or State Election.

State Nickname: "Hoosier State."

STATE OF IOWA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; first Monday in September, Labor Day; The day of the general election; Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Hawkeye State."
State Flower: Goldenrod.

STATE OF KANSAS.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; first Monday in September, Labor Day; October 12, Columbus Day; December 25, Christmas Day; any day recommended by the President of the United States or the Governor of the State as Thanksgiving Day, and any day which may hereafter be declared a legal holiday for the purposes of negotiable instrument act.

State Nickname: "Sunflower State."
State Flower: Sunflower.

STATE OF KENTUCKY.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; last Thursday in November, Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Blue Grass State."
State Flower: Goldenrod.

STATE OF LOUISIANA.

January 1, New Year's Day; January 8, Anniversary of the Battle of New Orleans; February 22, Washington's Birthday; Good Friday; June 3, Confederate Memorial Day; July 4, Independence Day; December 25, Christmas Day; Thanksgiving Day (as designated by the President); all general election days (in localities where elections are held); Mardi Gras Day (in the Parish of Orleans); first Monday in September, Labor Day; Saturday from 12 noon to 12 midnight (in cities and towns where the population is fifteen thousand or more).

State Nickname: "Pelican State."
State Flower: Magnolia.

STATE OF MAINE.

January 1, New Year's Day (bank holiday only); February 22, Washington's Birthday; April 19, Patriots' Day; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; last Thursday in November, Thanksgiving Day; December 25, Christmas Day; every day on which an election is held throughout the State, and every day appointed by the President of the United States, or the Governor of the State, for a public fast or thanksgiving day, or holiday.

State Nickname: "Pine Tree State."
State Flower: Pine Cone and Tassel.

STATE OF MARYLAND.

January 1, New Year's Day; February 22, Washington's Birthday; Good Friday; Arbor and Highway Day; May 30, Memorial Day; July 4, Independence Day; first Monday in September, Labor Day; September 12, Defenders' Day; October 12, Columbus Day; General Election Day; Congressional Election Day; November 23, Repudiation Day; December 25, Christmas Day; all special days that may be appointed or recommended by the Governor of the State, or the President of the United States as the days of thanksgiving, fasting and prayer or other religious observance, or for the general cessation of business; Saturday half-holidays (in some cities).

State Nickname: "Old Line State."
State Flower: Black Eyed Susan.

STATE OF MASSACHUSETTS.

February 22, Washington's Birthday; April 19, Patriots' Day; May 30, Memorial Day; July 4, Independence Day; first Monday in September, Labor Day; October 12, Columbus Day; last Thursday in November, Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Bay State."

STATE OF MICHIGAN.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; Election Days (embracing National, State, County and City Elections); December 25, Christmas Day; any day appointed by the Governor of this State, or the President of the United States, as a day of fasting and prayer or thanksgiving; Saturday afternoons a legal holiday for banks unless voted to the contrary by the directors.

State Nickname: "Wolverine State."
State Flower: Apple Blossom.

STATE OF MINNESOTA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; Good Friday; May 30, Memorial Day; July 4, Independence Day; Labor Day; Election Day; December 25, Christmas Day.

State Nickname: "Gopher State."
State Flower: Moccasin.

STATE OF MISSISSIPPI.

January 1, New Year's Day; January 19, Robert E. Lee's Birthday; February 22, Washington's Birthday; April 26, Memorial Day; June 3, Jefferson Davis' Birthday; July 4, Independence Day; first Monday in September, Labor Day; last Thursday in November, Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Bayou State."
State Flower: Magnolia.

STATE OF MISSOURI.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; any general State election day; any Thanksgiving Day appointed by the President of the United States or by the Governor of

the State; December 25, Christmas Day; every Saturday from 12 o'clock noon in cities of 300,000 population for county and municipal officers.

State Flower: Goldenrod

STATE OF MONTANA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; first Monday in September, Labor Day; October 12, Columbus Day; December 25, Christmas Day.

State Nickname: "Stub Toe State."

State Flower: Bitter Root.

STATE OF NEBRASKA.

January 1, New Year's Day; February 22, Washington's Birthday; April 22, Arbor Day; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; any day designated by Governor or President, Thanksgiving Day; December 25, Christmas Day.

State Flower: Goldenrod.

STATE OF NEVADA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; first Monday of September, Labor Day; October 31, Admission Day; Thanksgiving Day; December 25, Christmas Day; the day on which the primary election is held throughout the State, the day on which the general election is held, any day that may be appointed by the President of the United States, or by Governor of the State, for public fast, thanksgiving or holiday.

State Nickname: "Silver State."

STATE OF NEW HAMPSHIRE.

January 1, New Year's Day; February 22, Washington's Birthday; Fast Day (in April, whenever appointed by the Governor); May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Granite State."

STATE OF NEW JERSEY.

January 1, commonly called New Year's Day; February 12, called Lincoln's Birthday; February 22, known as Washington's Birthday; Good Friday; May 30, known as Decoration Day; July 4, called Independence Day; the first Monday of September, known as Labor Day; October 12, known as Columbus Day; December 25, known as Christmas Day; any general election day in this State; every Saturday from twelve o'clock at noon until twelve o'clock at midnight, and any day appointed or recommended by the Governor of this State, or the President of the United States, as a day of thanksgiving or fasting and prayer, or other religious observance.

State Nickname: "Jersey Blue State."

State Flower: Sugar Maple (tree).

STATE OF NEW MEXICO.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; July 4, Independence Day; October 12, Columbus Day; December 25, Christmas Day; and all days designated by proclamation of the Governor of the State as fast days or thanksgiving days.

State Flower: Cactus.

STATE OF NEW YORK.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; first Monday of September, Labor Day; October 12, Columbus Day; December 25, Christmas Day; each general election day and each day appointed by the President of the United States or by the Governor of this State as a day of general thanksgiving, general fasting and prayer, or other general religious observances; from noon to midnight of each Saturday.

State Nickname: "Empire State."

State Flower: Rose.

STATE OF NORTH CAROLINA.

January 1, commonly called New Year's Day; January 19, Robert E. Lee's Birthday; February 22, known as Washington's Birthday; April 12, Halifax Independence Resolutions; May 10, Confederate Memorial Day; May 20, Anniversary of Signing of Mecklenburg Declaration of Independence; July 4, called Independence Day; the first Monday of September, known as Labor Day; Thanksgiving Day; December 25, known as Christmas Day; General Election Day.

State Nickname: "Old North State."

STATE OF NORTH DAKOTA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; Arbor Day; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; Election Day; Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Flickertail State."

State Flower: Goldenrod.

STATE OF OHIO.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Decoration Day; July 4, Independence Day; 1st Monday of September, Labor Day; October 12, Columbus Day; December 25, Christmas Day; any day appointed and recommended by the Governor of the State or the President of the United States as a day of fast or thanksgiving.

State Nickname: "Buckeye State."

State Flower: Scarlet Carnation.

STATE OF OKLAHOMA.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; first Monday in September, Labor Day; October 12, Columbus Day; December 25, Christmas Day; every day on which an election is held throughout the State; every day appointed by the President of the United States, or by the Governor of the State, for a public fast, thanksgiving or holiday.

State Flower: Mistletoe.

STATE OF OREGON.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; first Monday in September; October 12, Columbus Day; December 25, Christmas Day; every day on which election is held throughout the State; every day appointed by the President of the United States, or by the Governor of the State, as a day of public fasting, thanksgiving, or holiday.

State Nickname: "Beaver State."

State Flower: Oregon Grape.

STATE OF PENNSYLVANIA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; Good Friday; May 30, Memorial Day; July 4, Independence Day; 1st

Monday in September, Labor Day; October 12, Columbus Day; 1st Tuesday after 1st Monday in November, Election Day; December 25, Christmas Day; every Saturday after 12 o'clock noon until 12 o'clock midnight; any day appointed or recommended by the Governor of Pennsylvania or the President of the United States as a day of thanksgiving or fasting and prayer, or other religious observance.

State Nickname: "Keystone State."

STATE OF RHODE ISLAND.

January 1, New Year's Day; February 22, Washington's Birthday; 2d Friday in May, Arbor Day; May 30th, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; Tuesday after first Monday in November, Election Day; Last Thursday in November, Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Little Rhody."
State Flower: Violet.

STATE OF SOUTH CAROLINA.

January 1, New Year's Day; January 19, Robert E. Lee's Birthday; February 22, Washington's Birthday; May 10, Confederate Memorial Day; June 3, Jefferson Davis' Birthday; July 4, Independence Day; 1st Monday in September, Labor Day; December 25, Christmas; National Thanksgiving and all general election days; the first Monday in September and Thursday of Fair Week in each and every year, in all the counties in the State in which the State Agricultural Mechanical Society holds an annual Fair. In Charleston and Richland Counties, each and every Saturday from 12 o'clock noon until 12 o'clock at midnight.

State Nickname: "Palmetto State."

STATE OF SOUTH DAKOTA.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; December 25, Christmas Day; and every day on which an election is held throughout the State, and every day appointed by the President of the United States, or by the Governor of the State, for a public fast, thanksgiving, or holiday.

State Nickname: "Swinge Cat State."
State Flower: Anemone Patens.

STATE OF TENNESSEE.

January 1, New Year's Day; February 22, Washington's Birthday; Good Friday; 2d Friday in May, Confederate Day; June 3, Jefferson Davis' Birthday; July 4, Independence Day; 1st Monday in September, Labor Day; last Thursday in November, Thanksgiving Day; December 25, Christmas Day; every day on which an election is held throughout the State, and every day appointed by the President of the United States, or by the Governor of the State, for a public fast, thanksgiving day, or holiday.

State Nickname: "Big Bend State."

STATE OF TEXAS.

January 1, New Year's Day; February 22, Washington's Birthday; March 2, Anniversary of Texan Independence; April 21, Anniversary of Battle of San Jacinto; June 3, Jefferson Davis' Birthday; July 4, Independence Day; first Monday in September, Labor Day; October 12, Columbus Day; December 25, Christmas Day; all days appointed by the President of the United States, or by the Governor, as days of fasting or thanksgiving, and every day on which an election is held throughout the State.

State Nickname: "Lone Star State."
State Flower: Blue Bonnet.

STATE OF UTAH.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; April 15, Arbor Day; May 30, Memorial Day; July 4, Independence Day; July 24, Pioneer Day; first Monday in September, Labor Day; December 25, Christmas Day, all days which may be set apart by the President of the United States, or the Governor of the State, by proclamation, as days of fast or thanksgiving.

State Flower: Sego Lily.

STATE OF VERMONT.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; August 16, Bennington Battle Day; 1st Monday in September, Labor Day; October 12, Columbus Day; December 25, Christmas Day; and a day appointed or set apart by the Governor, or by the President of the United States, as a day of thanksgiving, prayer or other special observance.

State Nickname: "Green Mountain State."
State Flower: Red Clover.

STATE OF VIRGINIA.

January 1, New Year's Day; January 19, Lee-Jackson Day; February 22, Washington's Birthday; May 30, Confederate Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; the Tuesday next following the first Monday in November, Election Day; December 25, Christmas Day; and any day appointed or recommended by the Governor of the State, or the President of the United States, as a day of thanksgiving or fasting and prayer, or other religious observance.

State Nickname: "The Old Dominion."

STATE OF WASHINGTON.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; May 30, Memorial Day; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Chinook State."
State Flower: Rhododendron.

STATE OF WEST VIRGINIA.

January 1, commonly called New Year's Day; February 12, called Lincoln's Birthday; February 22, Washington's Birthday; May 30, Decoration Day; July 4, Independence Day; 1st Monday in September, Labor Day; October 12, Columbus Day; Election Day; Thanksgiving Day; December 25, Christmas Day.

State Nickname: "The Panhandle."
State Flower: Rhododendron.

STATE OF WISCONSIN.

January 1, New Year's Day; February 22, Washington's Birthday; May 30, Decoration Day; July 4, Independence Day; Primary Election Day; General Election Day; Thanksgiving Day; December 25, Christmas Day.

State Nickname: "Badger State."
State Flower: Violet.

STATE OF WYOMING.

January 1, New Year's Day; February 12, Lincoln's Birthday; February 22, Washington's Birthday; Arbor Day; May 30, Memorial Day; July 4, Independence Day; General Election Day; Thanksgiving Day; December 25, Christmas Day.

State Flower: Gentian.

OCCURRENCES DURING PRINTING.*

The printing of a volume like the Scientific American Reference Book naturally takes several months. During this time changes are constantly occurring but it is impossible to go back and make them after the book has gone to press; therefore, advantage is taken of inserting in the last "form" whatever corrections and additions are necessary to bring the matter in the book up to date.

POPULATION.—According to the census of 1910 there were 1,346,925 women of voting age in the six states in which woman suffrage prevails (page 13). Woman suffrage was defeated at the last state election in Ohio; initiative and referendum amendment passed (Sept. 3).

The population of England and Wales (1910) was 36,070,492; the population of London proper was 4,521,685 and of Greater London, 7,251,687.

It is estimated that 1,000 persons were killed and from 5,000 to 6,000 injured in the earthquake which occurred on both sides of the Dardanelles, Turkey, Aug. 9. (Page 5.)

It is estimated that 50 persons were killed in the cyclone which swept Regina, Saskatchewan on June 30.

COMMERCE.—On Sept, 3 there was $1,220,-932,997.68 in gold in the vaults of the Treasury at Washington, Denver, San Francisco and New York.

11,221,624,084 cigarettes were smoked in the United States during the fiscal year ending June 30, 1912. The consumption of whiskey and rum was 133,377,458 gallons and of beer 62,108,733 barrels.

MERCHANT MARINE.—The German Survey Ship "Planet" sounded a depth of 32,086 feet, the greatest sea depth ever recorded, about 40 miles from Mindanao, P. I., during June.

The largest motor-ship yet constructed is being built for the Standard Oil Co., at Kiel, Germany. It is 420 feet long and 65 feet wide, carrying capacity 15,000 tons.

During the winter of 1912 the White Star liner Olympic will be renovated at a cost of $1,500,000: she will have side bunkers which practically means an inner skin. (Page 204.)

The new 50,000-ton liner being built by the White Star Co. will be named the Britannic.

For the first time in 35 years a merchant vessel flying the American flag sailed from New York for a Mediterranean port; the steamer is a 10,000-ton vessel named Robert M. Thompson.

The White Star liner Majestic has completed her 501st trip across the Atlantic, covering a total distance of 1,500,000 miles.

Aug. 28.—French liner "France" made voyage from New York to Havre in 5 days, 16 hours (page 215).

Empress of Russia, 15,000-tons, built for Canadian Pacific Railway Co. was launched at Glasgow.

Sept. 2.—Steamer Nantucket took fire and turned turtle at Baltimore. 1 person killed.

Sept. 3.—7 men of crew of sailing vessel Criocieth Castle lost at sea.

Sept. 23.—Steamer Obnovka sunk in collision on River Devina, Russia. 115 drowned.

New Holland-American liner (page 203) will be named the "Statendam."

RAILROADS.—A 30,000 foot tunnel costing $10,000,000 is being dug in the Sierra Nevada Mountains by the Harriman System (Page 258.)

Sept. 6-8.—Dr. Barker covered 1,331 miles in 40 hours, 48 minutes from a camp in the North Carolina Woods to Bar Harbor, Me. (Page 253.)

WIRELESS.—A Wireless system is to be established in Argentine Republic capable of receiving and sending messages at 612 miles.

The German Telefunken Co. has established wireless communication over the Andes between Lima and Para a distance of 3,400 kilometers. (2,112 miles.)

It is expected that the new wireless station at Nauen, near Berlin, will include New York in its radius of action.

Regular commercial service has been established between San Francisco and Honolulu.

The Norwegian Government is erecting high-power stations in Norway for the purpose of conducting commercial telegraph service between New York and northern Europe.

The largest wireless station in the world is being erected at Carnarvon, Wales.

Esperanto is transmitted under same tariff as code and cipher messages. (Page 191.)

PRESS CABLE RATES.—It is highly probable that the present press cable rate of 12½ cents between Germany and the United States will be cut to 7 cents, meeting the recent cut of the Western Union (page 292); a statement issued by the French Cable Co. seems to indicate that no such step is likely to be taken in regard to a cut between France and the United States.

POST OFFICE.—A deputation of 100 prominent representatives of France, Great Britain, Germany, Russia, Austria, Belgium, Italy, Holland and Turkey is about to be organized with a view to obtaining a world-wide two cents post.

Point Barrow, Alaska, is the northernmost Post Office of the United States.

NAVY.—The United States submarine holds a world's record after diving 283 feet off Point Diablo in San Francisco Bay.

President Taft has withdrawn 37,000 acres of oil fields in the Elk Hills, Cal., as a reserve source of fuel for the navy.

Sept. 14.—German torpedo-boat G-171 rammed by Battleship Zahringen. 6 men killed.

Sept. 15.—10 naval apprentices drowned at the Great Lakes Training Station on Lake Michigan when a cutter was swamped.

AVIATION.—Georges Legagneux attained a height of 18,681 feet at the Villacoublay Aerodrome (Paris) breaking the world's record. (Page 454.)

193 aviators have been killed since the beginning of aeroplane flying; there were 73 deaths in 1911 and 77 up to Sept. 30 in 1912 (Page 31). 53 army aviators have been killed since Sept., 1908.

MISCELLANEOUS.—The largest office building (floor space) in the world is to be erected on the site of the Equitable Life Assurance Co., New York, at a cost of $29,000,000, including the cost of the site.

October 9 will be observed throughout the schools of New York State by instruction regarding the prevention of fire as "Fire Prevention Day." (Page 583.)

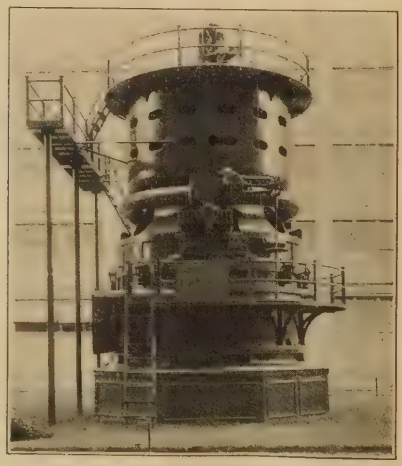
*The latest information given in this book bears date Oct. 4, 1912.

SUBMARINES OF THE UNITED STATES.

Name or Number.	Where Built.	Launched.	Dimensions. Length.	Beam.	Draught.	Number of Screws.	Displacement.	Indicated Horse-Power.	Maximum Trial Speed.	Armament. Guns.	Torpedo Tubes.	Complement.	Maximum Coal Capacity.
Adder	Elizabethport	1901	63 4	11 9	..	1	120	160	7—8	..	1	..	..
Grampus*	S. Francisco	1902	63 4	11 9	..	1	120	160	7—8	..	1	..	..
Holland	Elizabethport	1896	54 0	10 3	..	1	74	150	8	..	1	6	..
Moccasin	Elizabethport	1901	63 4	11 9	..	1	120	160	7—8	..	1	..	..
Pike	S. Francisco	1902	63 4	11 9	..	1	120	160	7—8	..	1	..	..
Plunger	Elizabethport	1902	63 4	11 9	..	1	120	160	7—8	..	1	..	..
Porpoise	Elizabethport	1901	63 4	11 9	..	1	120	160	7—8	..	1	..	..
Shark	Elizabethport	1901	63 4	11 9	..	1	120	160	7—8	..	1	..	..
Cuttlefish	Quincy, Mass.	1906	80 6	13 0	..	..	170		8¼—10	..	1	..	..
Viper	Quincy, Mass.	1909											
Tarantula	Quincy, Mass.												
Octopus	Quincy, Mass.	1906	106 0	..	..	..	273						
Stingray	Bldg.	1909	..	..	..	..	239—274	500	..	..	2	..	..
Tarpon	Quincy, Mass.	1909											
Bonita	Quincy, Mass.	1909											
Snapper	Quincy, Mass.	1909											
Narwhal	Quincy, Mass.	1909											
Grayling	Quincy, Mass.	1909											
Salmon	Quincy, Mass.	1909	..	..	..	..	278—340	..	..	..	4	..	..
Skipjack	Quincy, Mass.	Bldg.	160·0	13 0	..	..	525	..	9¼—14	..	6	..	..
Sturgeon	Quincy, Mass.												
Carp	San Francisco												
Barracuda	San Francisco												
Pickerel	Seattle												
Skate	Seattle												
Thrasher	Philadelphia												
Tuna	Newport News												
Seal	Newport News	1911											
Nos. 28–31 (4)	Quincy, &c.	Bldg.											
Nos. L–III. (3)*	..	1910	..	..	..	..	..	..	22	..	..	..	..

* Sub-surface destroyers

Letters and numbers instead of names are now used for all submarines.



THE FIRST CURTISS TURBINE NOW AN EXHIBIT.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The American Association for the Advancement of Science, organized in 1848, is a learned society existing as a continuation of the American Association of Geologists and Naturalists, organized in 1840. It was chartered in its present form in 1874. At present it has a membership of about 8,000. Any person may become a member of the association upon recommendation in writing of two members or fellows, after which he is elected to membership by the Council, or by the special committee of the Council resident in Washington. The admission fee for members is $5 and the annual dues $3.

Fellows are elected by the Council from such of the members as are professionally engaged in science. On the election of any member as a fellow, a fee of $2 is paid in addition to the annual dues of $3.

Any member or fellow who pays the sum of $50 to the association, at any one time, becomes a life member and as such is exempt from all further assessments. Any person paying the sum of $1,000 is classed as a patron.

The association is made up of 11 sections as follows:

Mathematics and Astronomy; Physics; Chemistry; Mechanical Science and Engineering; Geology and Geography; Zoology; Botany; Anthropology and Psychology; Social and Economic Science; Physiology and Experimental Medicine; Education.

NATIONAL ACADEMY OF SCIENCES.

The National Academy of Sciences was incorporated under the Act of Congress May 3, 1863, with the object that it "shall, whenever called upon by any department of the Government, investigate, examine, experiment and report upon any subject of science or art; the actual expense *** to be paid from appropriation which may be made for the purpose." The Association can not, under any circumstances receive compensation from the government for its services. The annual meeting is held in Washington on the third Tuesday in April; annual reports are made each year at the Autumn meeting which is held at such places in the United States as may be designated by the Council. The membership of the Association is limited to 150, not more than 10 to be elected in one year; the number of foreign associates is limited to 50. There are at present 120 members and 44 foreign associates.

THE SMITHSONIAN INSTITUTION.

The Smithsonian Institution was created in 1846 by an Act of Congress in accordance with the provisions of the will of James Smithson, an English chemist and mineralogist, who bequeathed his fortune to the United States for the purpose of establishing at Washington, an institution for "the increase and diffusion of knowledge among men." From the income of the fund the building, known as the Smithsonian Building, was erected in Washington, D. C. The institution is legally an establishment having as its members the President of the United States, the Vice-President, the Chief Justice and the President's Cabinet. It is governed by a Board of Regents consisting of the Vice-President, the Chief Justice, three members of the United States Senate, three members of the House of Representatives and six citizens appointed by joint resolution of Congress.

For increase of knowledge, the institution aids investigation by making grants for research and exploration, supplying books, apparatus, etc. It occasionally provides lectures which are published; initiates scientific projects; publishes scientific papers. For the diffusion of knowledge the institution issues three regular series of publications: "Annual Report," "Smithsonian Contributions to Knowledge," and "Smithsonian Miscellaneous Collections." The institution in co-operation with the Library of Congress maintains a scientific library which contains about 260,000 volumes. The original endowment of $541,000 has been increased by gifts and accumulated interest to $987,000, yielding an annual income of $58,375.

THE UNITED STATES CENSUS BUREAU.

The work of the Bureau of the Census, which is under the control of the Department of Commerce and Labor, is divided into two main branches, namely, the taking of the decennial censuses of the United States, and of collecting such special statistics as are required by Congress. The thirteenth decennial census was taken in 1910 and in accordance with the Act of Congress approved July 2, 1902, covered population, agriculture, manufactures and mines and quarries.

The special statistical inquiries, which are mostly made in the intervals between the decennial censuses, include statistics of births and deaths in registered areas; statistics regarding the insane, feeble-minded, deaf and dumb, and blind; crime, pauperism and benevolence; social and financial statistics of cities; wealth, debt and taxation; religious bodies; electric light and power, telephones and telegraphs, and street railways; transportation by water; cotton production and distribution; and production of forest products. The statistics relating to deaths in cities and to the production of cotton are secured annually; the other statistics mentioned are secured at intervals of from five to ten years, but not at the same time as the regular decennial censuses.

THE PRESIDENTIAL SUCCESSION.

In case of the removal, death, resignation or inability of both the President and Vice-President, then the Secretary of State shall act as President until the disability of the President or Vice-President is removed or a President is elected. The remainder of the order of succession is as follows: Secretary of the Treasury, Secretary of War, Attorney-General, Postmaster-General, Secretary of the Navy, and Secretary of the Interior. The acting President must, upon taking office, convene Congress, if not at the time in session, in extraordinary session, giving twenty days' notice.

FOOD SOURCES OF THE WORLD.

SPARKLESS WIRELESS SYSTEM.

A system of sparkless wireless telegraphy has been invented by a young French engineer, Julien Bethenod, by which it is said to be possible to establish wireless stations in close proximity to one another without the messages being confused and also to exchange communication ten times faster than by submarine cables at about one-tenth the expense. This system necessitates as a plant only an alternator and antennae of a special character. Bethenod's discovery also makes wireless telephony more possible. With a spark, only 2,000 oscillations per second can be produced; by sparkless wireless telephony, 20,000 oscillations can be produced, which is about the same as the human voice.

THE UNITED STATES CIVIL SERVICE.

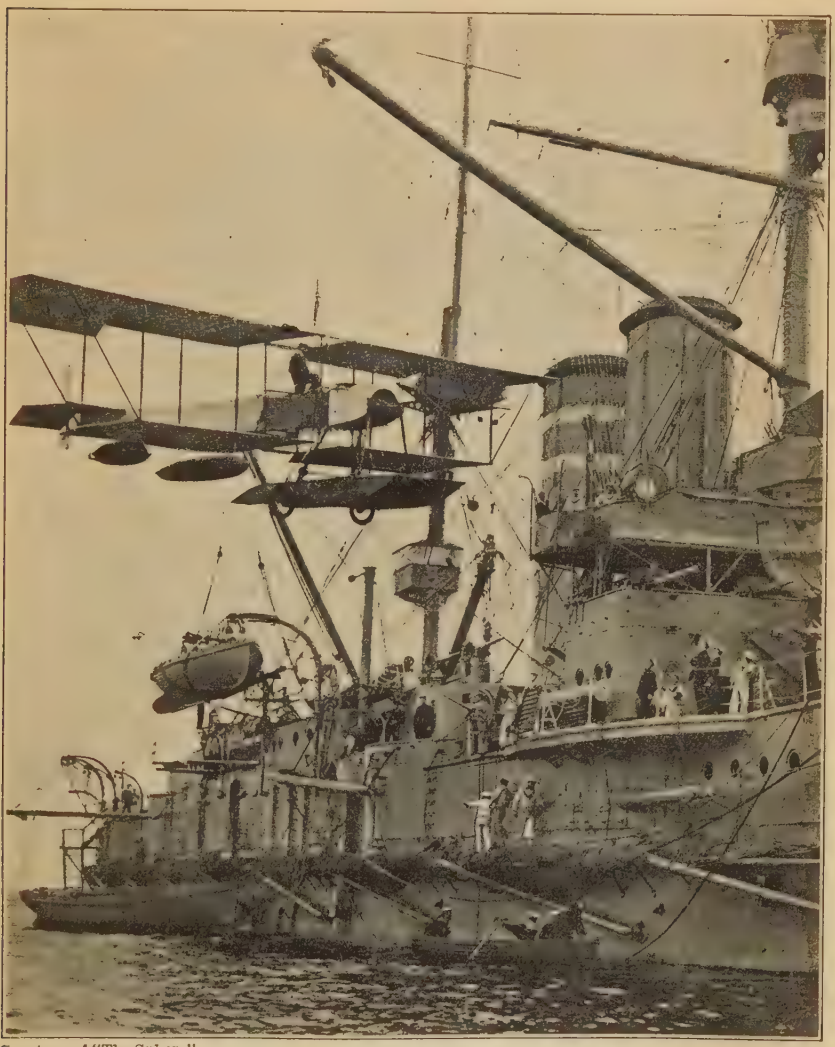
The United States Civil Service Act approved January 16, 1883, provides for the appointment of three Commissioners, a Chief Examiner, a Secretary, and other employes, by the President, to assist him in classifying the government offices and positions, formulating rules and enforcing the law.

GENERAL RULES.—The purpose of the Civil Service act is "to regulate and improve the Civil Service of the United States." The act requires the rules to provide for free and open examinations of applicants for positions in the public service; that appointments shall be made from those graded highest in competitive examinations; for the apportionment of appointments at Washington among the States upon the basis of population; for a period of probation of six months before any absolute appointment is made.

APPLICATIONS.—All applicants for examinations must be citizens of the United States, and of the proper age. No person will be examined who is physically disqualified for the service which he seeks; who has been guilty of criminal, infamous, dishonest or disgraceful conduct; who is addicted to the use of intoxicating liquors to excess; who has been dismissed from the public service for delinquency and misconduct and who has failed to receive absolute appointment after probation. No discrimination is made on account of race, color, or political or religious opinions.

EXAMINATIONS.—The examinations are opened to all persons qualified as above. The examinations are held twice a year in each State and Territory, before boards of examiners chosen from among persons in government employ. The dates and places of examination are publicly announced through the newspapers or other means. Full information as to rules governing examinations, manner of making application, etc., is given in the "Manual of Examinations," which may be obtained free by writing to the commission in Washington.

APPOINTMENTS.—It is necessary to obtain an average of 70 per cent. to be eligible for appointment. In case of a vacancy, the names of three persons standing highest of the sex desired on the eligible list are given to the appointing officer who chooses any one of the three names, returning the other two to the register to await further consideration. No person can be removed from a competitive position except for such cause as will promote the efficiency of the public service and for reasons given in writing. The salaries vary in the different departments and cannot be given in the short space allotted to the subject.



Courtesy of "The Sphere"

HOISTING ON BOARD A NAVAL HYDRO-AEROPLANE

LONGEST RIVERS OF THE WORLD.

Exceeding 2,000 miles in length.

River	Length
North America	
Mississippi-Missouri	4,194
Yukon	2,050
Colorado	2,000
South America	
Amazon	3,300
La Plata	2,950
Africa	
Nile	3,670
Kongo	2,806
Niger	2,600
Asia	
Obe	3,235
Yangtsekiang	3,000
Lena	2,860
Amur	2,700
Mekong	2,600
Yenisei	2,500
Hwangho	2,300
Indus	2,000
Europe	
Volga	2,325

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